SCIENTIFIC AMERICAN

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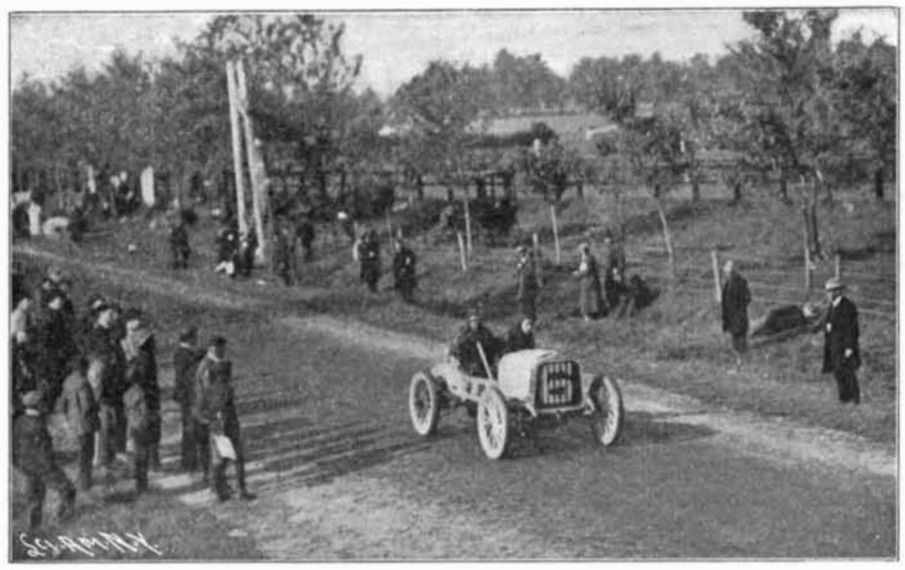
Vol. XCI.—No. 17. Established 1845. NEW YORK, OCTOBER 22, 1904. [8 CENTS A COPY $3.00 A YEAR.

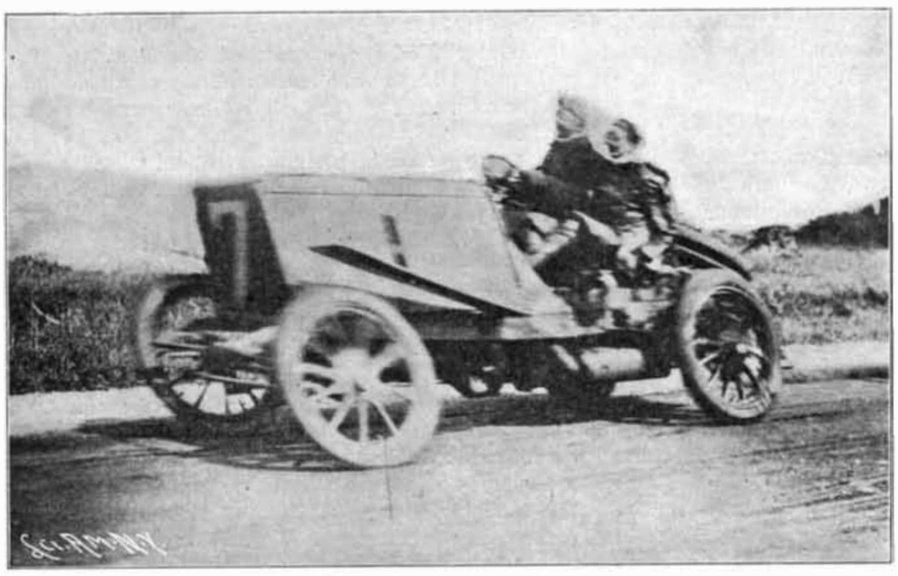
Finished second.

Clement, Jr. Starting in 90-Horse-Power Clement Bayard.



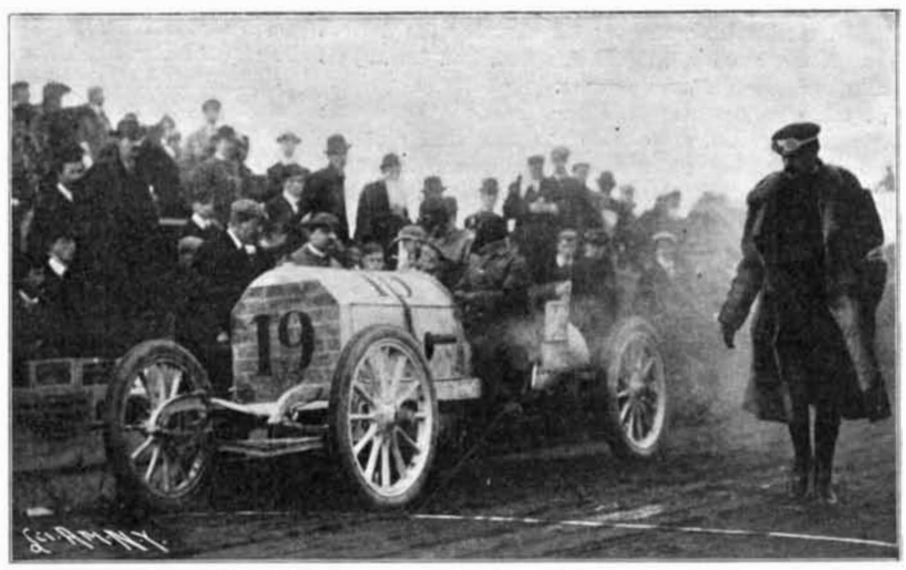
The low-powered car that took third place.

Lyttle in 24-Horse-Power Pope Toledo.



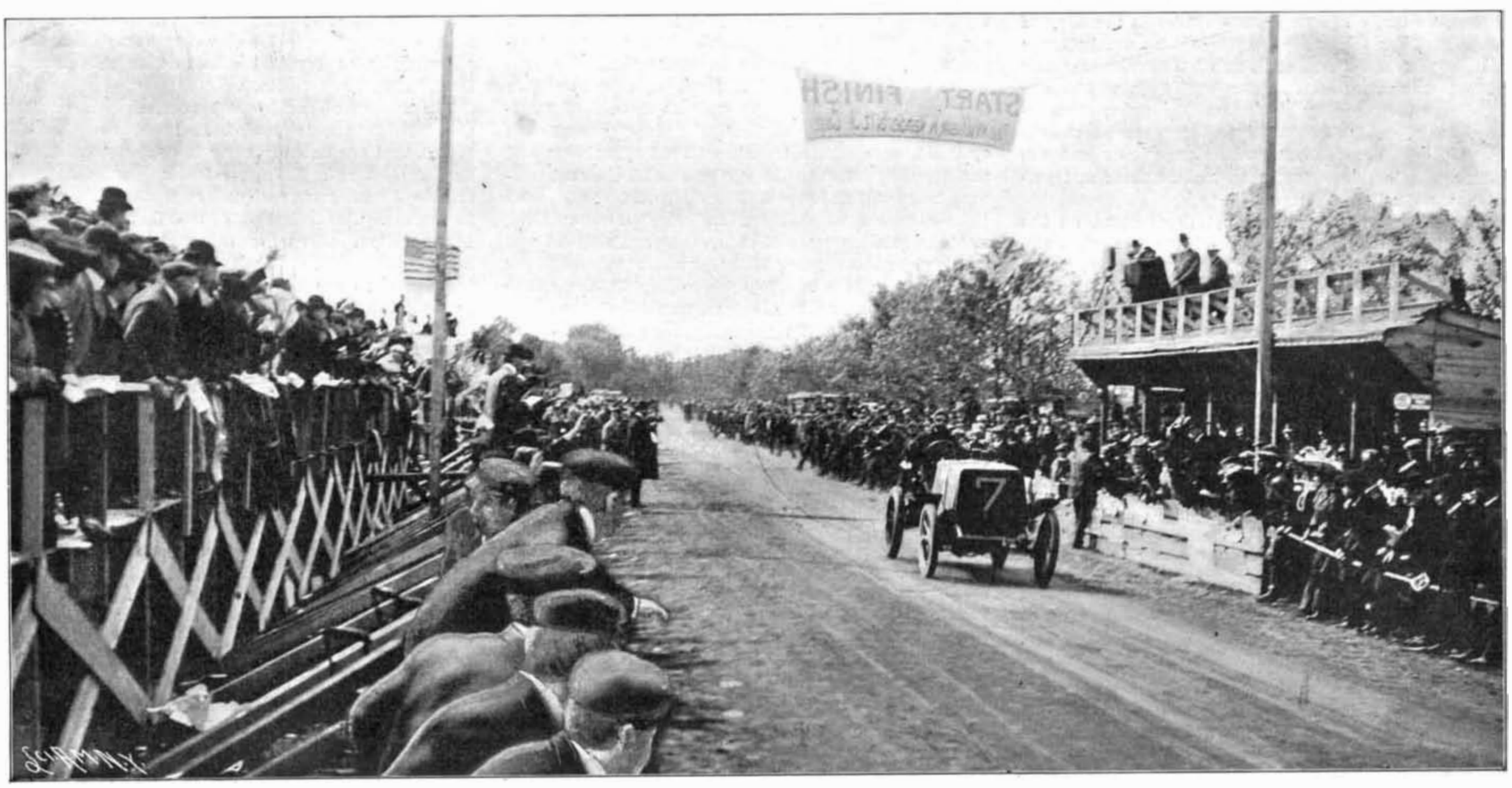
Snapshot at 80 miles an hour.

Heath in 90 Horse-Power Panhard.



Broke clutch in first round.

Wallace in 90-Horse-Power Fiat. W. K. Vanderbilt, Jr., the Donor of Cup.



The Finish. Heath Winning by 1 Minute, 28 Seconds. Average Speed, 52.2 Miles Per Hour.—[See page 283.]

THE VANDERBILT INTERNATIONAL CUP CONTEST.

SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845) ....$3.00 a year
Scientific American Supplement (Established 1876) .... 5.00 "
Scientific American Building Monthly (Established 1885)........ 2.50 "
Scientific American Export Edition (Established 1878). .... 3.00 "

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, OCTOBER 22, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

AUTOMOBILE ROAD RACING.

Not for a long time have we seen such an ill-timed display of prejudice, as was shown by some of the daily press against the international automobile race, recently held on Long Island. The arguments advanced were illogical; for, if pressed home and broadly applied, they would make a clean sweep of every form of sport that involves the element of danger, or calls for the supremest development of mental and bodily powers.

A careful sifting out of the voluminous correspondence and lengthy editorial criticisms of the race shows that it was condemned mainly on two counts: first, that it was dangerous to the competitors, and second, that the machines they drove were over-developed mechanisms, fit only for carrying the drivers through the race at break-neck speed, and having no subsequent usefulness whatever.

It takes only a moment's consideration to see that the same objections apply to the racehorse and the racing yacht, to say nothing of various forms of sport such as football, polo, and some that are less prominent in the public eye. Set a ban upon every competition that entails danger to life or limb, and we would be at once reduced to croquet, shuttlecock and battledore, and a few other thrilling diversions that were the delight of our forefathers. Risk is inseparable from any high form of sport; and we have to recognize the fact that human nature is so constituted that this very element of risk does in itself form one of the strongest attractions of the sports that are popular in the present day. It was so in the days when the queen of the tournament watched the contesting knights meet in the terrific shock of encounter, and it is so to-day when the gentlest women of the country are to be found forming a large percentage of the interested spectators of an automobile contest. The editorial writers who spilled so much ink in deploring the reckless folly of this race on Long Island, no doubt had their forerunners in the days of Richard Cœur-de-Lion, when there was surely much wagging of heads and shaking of fingers, and many "I-told-you-so's" filled the air; and they will doubtless have their worthy successors fifty years from today, when, on the eve of some international airship contest or other "folly," the correspondent and the editor will join in deprecating foolhardiness and predicting unlimited disaster.

The second indictment against these races, on the ground that they serve no useful purpose whatever, is equally futile. And, unlike the first charge, it has no basis whatever in fact. The donor of the cup gave it for the express purpose of stimulating the automobile industry, by enabling our mechanics to learn those lessons regarding the faulty features in the design and the weak elements in the construction of their machines, which can only be disclosed during the terrific strain to which an automobile is put in covering the several hundred miles of the course at its topmost speed. It is begging the question to claim that all this information may be gathered during an ordinary run at touring speed over country roads; for it is not once in a hundred trips that a touring machine is put to the severe strains to which a racer is subjected over and over again during one of these contests. Take the case of the two machines in the recent race that use the bevel drive—one a 35-horse-power Royal American machine, the other a 90-horse-power French Renault. Each of these broke its main drive shaft; moreover, in each case the smash occurred very early in the race—a clear indication that whatever are the merits of this form of drive, particular care must be taken in proportioning the shaft to its work. Take the case of another machine that broke the steering knuckle lever a day or two before the race, and in the race itself broke this same part. It is conceivable that the firm who manufactured this machine might have continued to use the same pattern on their standard makes, had not its inherent weakness been thus clearly demonstrated in this contest. Furthermore, the fact was established in the case of practically every machine in the race that the weakest point of the automobile, the one in which trouble will come first, when the machine is hard pressed, is the tires. Doubtless this was known before; but it is certain that the experience gathered in this race will result in special attention and renewed effort upon the part of the tire makers.

Unquestionably, in respect of its usefulness, automobile road racing stands and falls with the thoroughbred horse and the racing yacht. It goes without saying that the sport of horse racing, with its development of the racehorse, has had a widespread and lasting effect in improving the breed of horses in general. So also the development of a "Reliance" or a "Shamrock" through the past half a century of international cup racing has been a most powerful factor in the improvement of sails, both in texture and cut; has stimulated, on the part of shipbuilders, the search for light but strong materials of construction; and has led to the adoption of many forms and methods of construction at once lighter and stronger than those formerly common to the art.

SCIENTIFIC DISPOSITION OF SEWAGE.

BY CHARLES F. HOLDER.

"The English walnut crop of 1903 of the Pasadena, California, Sewer Farm has been purchased by P. R. Wilding, a commission merchant of Los Angeles, for $7,419. This is the third consecutive year that Mr. Wilding has bid for and received the crop."

The above item appeared in the Los Angeles papers in November, 1903, and is of interest, as beneath it we may read the story of a very successful disposition of sewage from a city of 15,000 or 20,000 inhabitants. Indeed, Pasadena claims to have solved the question of the scientific disposition of its sewage, and can demonstrate to any interested parties that the work is accomplished not only successfully, but is a good business proposition to the city.

The city of Pasadena lies on the gentle slope of the Sierra Madre, at the head of the San Gabriel Valley, and covers practically twenty-five square miles, the city, including Altadena, reaching to the mountains on the north and from the banks of the Arroyo Seco to Lamanda Park to the east. For many years, and when the city was in its incipiency, the sewage was received in cesspools; but some years ago a system of sewage became necessary, and plans were at once begun, resulting in the present arrangement, by which the central portion of the city is well sewered. The plant, consisting of about fifty miles of pipe, has 650 manholes, 140 flush tanks, and all the modern features which go to make up a perfect system, all of which cost the city in the neighborhood of $313,457. The establishment of a plant was comparatively a simple matter, but to convey the sewage to the ocean—thirty or more miles distant—was a problem which seemed insurmountable. Many people would not give the right of way; others attempted to demonstrate that the pipe would break, and contagion would fill the air along the line. All the neighboring towns and dependencies of Pasadena rose in open revolt, and for a while the singular situation was seen of a city with a sewer system assured yet with no method of disposition. This was solved finally by the purchase of a tract of three hundred acres of land lying four and three-quarter miles to the southeast of Pasadena, midway between the town of Alhambra and the Mission Hills—a region which, it was well known, but required water to produce crops of many kinds. This land was acquired by the city for $37,500, and named the Sewer Farm, where it was proposed to deposit the entire sewage of Pasadena, and, briefly, turn it into money to recoup the city for its general sewage expense.

The sewer farm is, roughly speaking, about five miles and a half from Pasadena, and the outfall pipe is about that length, 22 inches in diameter and of vitrified clay. It was placed five feet beneath the surface, having a fall of 31 2-3 feet per mile. There were several features here not found in the East, where rains flush the sewers continually. There was no rain from May to November, hence rain or a natural flow of water could not be depended upon; yet no serious difficulty has been experienced, the natural flow of the waste water being all-sufficient for the purpose. The farm is in the hands of a practical farmer, who runs it on scientific principles, and for nearly a decade it has been a yearly value-increasing asset of the city.

The farm is divided by a road, so that one-half lies on each side, and is conducted as a continual producing proposition. In a word, it is worked over and over again, producing just as many crops a year as it can be forced to, the continuous supply of sewage enriching the soil indefinitely. That timber is raised is evident by the fine forest hedge and windbreak of eucalyptus trees—among the most rapid growers known when there is an abundant supply of water. They are self-producing, that is, when the tree is cut it at once throws up new stalks, and in a short time a new tree is ready for the ax, the wood being valuable for many purposes. The wood is used for fuel, the leaves as an ingredient for medicine and oil. At present the trees are nearly one hundred feet high, and as they have been planted ten feet apart, in ten rows, they form a magnificent line two miles and a half in length—a landmark for a long distance.

The best product of the farm is the English walnut grove, it being found that these trees lend themselves especially to this treatment, and ninety acres have been planted with them, the trees in size and condition being among the finest to be seen in Southern California. This plot alone produces between $7,000 and $8,000 every year, and that it is almost net, the simplicity of cultivation shows. Of this ninety acres in walnuts, sixty is in old trees, thirty in young ones; and the rapid increase in value and number is seen in the fact that the crop of fruit last year, or the year ending January, 1903, was $4,738, the crop weighing 45,131 pounds. This crop is ripe in October, at about the same time as the chestnut of the East, and a large number of pickers, among whom are Indians, Mexicans, and half-breeds, are employed. The nuts are knocked or shaken from the trees by men armed with poles who are followed by pickers with gunny sacks, who carry them to the sheds, where they go through several operations before being ready for the market. A large acreage of the farm, at least twenty, is planted to pumpkins, which grow to a remarkable size and make an extraordinary display when ripe. They are used to feed stock, principally hogs, of which there is a herd at present of two hundred. One hundred and thirty acres are planted to barley, which is the principal hay crop of California; and so complete is the system that two perfect crops are raised, the same being true of corn; and doubtless as the farm is perfected, experiments will demonstrate that many crops can be duplicated.

The secret of the success of the Pasadena farm method lies in the application of the sewage. Before planting time a horse and plow form several inclosures on the surface to be planted, after the fashion of the long furrow seen in orange irrigation, the idea being to hold the sewage in a location until the fluid permeates the earth thoroughly and completely as would a good rain, that is, to a depth of three or four feet. This accomplished, it is allowed to dry sufficiently for working, when a cultivator is put on, and the ground from twelve to fourteen inches, the deeper the better, thoroughly cultivated and turned over. This is found in the soil at the Pasadena Sewer Farm to not only prepare the ground for the reception of seeds, but to render it perfectly "sweet," so there is no disagreeable odor, the hot sun acting as a deodorizer. So thorough is the work of Nature after this simple treatment, that the farm managers state that there has never been a case of illness that could be traceable to the sewage or as a result of working in it. A criticism of such irrigation has been made that certain fruits and grasses may carry the impurities, but this is obviated here by an exact system. Thus so complete is the original irrigation that a later application is not necessary, as in the case of pumpkins or squashes. Fruits, as strawberries or anything that touches the earth and lies upon it, are not raised.

The section of corn, which requires rain or subsequent irrigation, is flooded in lines, and the lower leaves, that are liable to come in contact with the sewage, are burned. Briefly, scientific methods prevail, combined with great care and common sense, resulting in success. The irrigation of this farm is an interesting operation. The writer observed it on one occasion, and supposed that the sewage pouring out was irrigating water, so apparently pure was it, there being no perceptible odor at a distance of several feet. This is due to the fact that the output of the sewage is more than 75 parts pure water that reaches the pipes with the deposits from water pipes, closets, etc. The pipe on reaching the farm is divided, and led about it in a way to produce the best results, so that one section can be flooded or the whole, the entire flow being at the command of the manager. In many European countries and in Australia methods have been tried which have proved extremely expensive. The Pasadena farm is the simplest that can be devised, being, in a word, deep irrigation and deep cultivating, soaking the ground for three or four feet and cultivating for nearly two feet—the deeper the better. Everything is made to pay on this farm. The refuse fodder is cleaned out by renting the ground to sheep herders at $3 per day, the animals eating it up clean. The amount of hay raised furnishes the city horses, the fire department, and others with their food supply, leaving an amount sufficient for the farm horses and an abundance to sell.

The farm, while in operation some time, is yet in a developmental stage, or while a practical business success is not old enough to produce its maximum result; and judging by the present progress, the municipality

which is but a little over twenty-five years old itself, expects in a few years to net from twenty to thirty thousand dollars per annum from its sewage. The various figures of the farm are not essential, but one may be given as suggestive of the success of the plant. The price received from the walnut crop alone in 1903 was $7,419. The running expenses of the farm for the fiscal year ending January, 1903, including everything, from the salary of the manager down, were about $5,000, so that ninety acres out of three hundred paid all the expenses and left a balance of $2,400.

A LIFE-SAVING MUSEUM.

BY GEORGE E. WALSH

The effort made to establish in New York a museum of safety has attracted the widespread attention of manufacturers, who are interested in the present high industrial death rate that prevails in this country through causes which could be largely removed by the adoption of precautionary methods. We are the foremost nation of the earth in the invention of safety devices and appliances; but our industrial death rate is the highest of all the large manufacturing nations. Either we are careless of the individual life of workmen, or through ignorance or willfulness we do not take the medicine prescribed by ourselves. Our safety appliances are used in manufacturing plants in all parts of the world, but often their use is neglected right at home. Many of the thousands of devices intended to protect workmen from injuries in various dangerous employments are merely of local use, and they are of no general advantage to the industrial world. A more general knowledge of the use and value of safety appliances should result in safeguarding human life in all departments of work. A museum of safety would form a nucleus for working plans and models of all devices intended to protect workmen from their own carelessness or from conditions over which they have no control. Both manufacturers and employes would have object lessons presented to them in such a collection of inventions, and there would be few trades or industries that could not draw some valuable results from the exhibition.

In Germany manufacturers have united in a movement to lower the industrial death rate, while in Holland there has been for some time a museum of safety, which has demonstrated the value of educating the public in the use of safety appliances. Another such museum is located at Milan; but the Amsterdam institution has furnished more data for the general public than the smaller one in southern Europe. Every effort is made to secure working models of new safety appliances for exhibition at the Amsterdam museum, and one can find grouped therein hundreds of practical devices for lessening the industrial death rate. These devices are gathered from all parts of the world, and scores of American inventions are exhibited there, so that a manufacturer or workman from this country can study to the best advantage the improvements made by his own countrymen in this direction.

The Amsterdam museum of safety, after which it is intended to model the New York institution, exhibits specimens of the safety appliances in actual operation. A great many of these devices are intended to prevent injuries that partly incapacitate, but do not kill. Injuries to delicate organs that render the workmen almost useless for further efforts in their trade are so common, that we find among the unskilled class of laborers a fair proportion of old men who were trained in some particular trade, but through gradual injury to eyes, ears, mouth, lungs, or other organ, they were forced to give up their chosen profession and drop back among the unskilled class. Stonecutters blinded by the fine powdered dust of the chiseled stone have to seek some other line of work, and plasterers half blind from some lime or mortar that has spattered in their eyes become almost helpless in their old age.

Fully as pathetic is the disabling of workmen for life by failure to adopt simple mechanical precautions that science has devised for them. Workmen as a rule are less ready to accept new safety inventions for their own protection than employers, who must go to the expense of purchasing the appliances. The education of the workmen to an appreciation of their duty in this matter is one of the objects of the modern safety museum. In factories the whirring machinery appears to the visitor a dangerous power that is waiting for its victims, to grind up or maim for life; but the operators grow so accustomed to the scene that there is no fear or little thought of any possible danger. In some unguarded moment, however, an arm or leg is sacrificed, to warn others of the danger. It is the consensus of opinion of manufacturers that no machinery in operation should be left unguarded and unprotected, and it is possible to prevent nearly all accidents by safety contrivances that will keep heedless or ignorant operators from getting caught. Belts have their guards, so they cannot slip and catch an unfortunate victim; wheels and buzz saws have circular sheaths, so that it is impossible for one to meet accidents with them; piston rods and flywheels of engines have steel wire inclosures, so that the forgetful will not run against them; and nearly all of the moving parts of the machinery are painted in vivid red to attract the eyes. This employment of a color that stands out distinctly to warn the operators is an advance in modern factory and engine-room practice that saves many needless accidents. With every moving part of the machinery painted red, from shafts and flywheels to small valves and slides, the workmen are safeguarded to some extent; but in the up-to-date mill or factory, further devices are employed to keep the operators from getting caught. Extraordinary precautions to make up for man's inherent weakness and forgetfulness are apparent to the visitor in a modern museum of safety.

Modern inventions for protecting workmen from accidents and injury while in the performance of their ordinary work have lessened the mortality greatly among them in recent years; but there is still plenty of room for further improvement. With the invention of new forms of machines and employments each year, there comes the corresponding need of more devices for protecting operators. But probably the greatest need to-day is a more general use of the safety appliances already invented and in use in a limited way. Thousands of these are neglected in mills, factories, and mines on account of lack of forethought or ignorance. Owners of plants do not always have the time to study the hundreds of devices invented for this purpose, and they are not sure that they would do all that is claimed for them.

With a museum of safety with all the important safety devices exhibited, there would be no further room for ignorant excuses. A day's study of the contents of the institution would reveal to any one the possibilities of safeguarding the lives of operators in any trade or profession. Since the establishment of the Amsterdam museum, it is estimated that thousands of lives have been indirectly saved through the more general adoption of safety devices by manufacturers and mine owners. Until these appliances were exhibited, little was known about them. It has also resulted in the passing of laws compelling employers of labor in certain lines to use safety devices that have been found to give beneficial results. The direct outcome of the founding of such a museum in New York would be far-reaching, and in the end it would tend to lessen the industrial death rate in this country to a considerable degree.

THE SCIENTIFIC AMERICAN REFERENCE BOOK.

It is with a sense of great gratification that we are able to announce that the "Scientific American Reference Book" has been published. The Editor of the Scientific American receives during the year thousands of inquiries from readers and correspondents covering a wide range of topics. The information sought for, in many cases cannot be found readily in any available reference book or textbook. The publishers of the Scientific American decided, many months ago, to prepare a work which should be comprehensive in character, and which should contain a mass of information not readily procured elsewhere. It was at first intended to issue a 144-page book; but as the work progressed, and the wealth of material increased, it was seen that the wants of its readers could never be satisfied by a book of this size, and it was extended to 516 pages. This work has been made as non-technical as the subjects treated of will permit, and it is intended as a ready reference book for the home and the office. Among the subjects treated are "The Progress of Discovery"; "Shipping and Yachts;" "Navies of the World"; "Armies of the World"; "Railroads of the World"; "Population of the United States"; "Education"; "Telegraphs," "Telephones," "Submarine Cables," "Wireless Telegraphy," and "Signaling"; "Patents"; "Manufactures"; "Departments of the Federal Government"; "Post Office"; "International Institutions and Bureaus"; "Mines and Mining"; "Geometrical Constructions"; "Mechanical Movements"; "Chemistry"; "Astronomy"; "Weights and Measures." Many of the diagrams and engravings are comparisons made especially for the work. The debt for advice and help has been a heavy one. The compilation of this book would have been impossible without the cordial co-operation of government officials, all of whom have been most kind. There are six colored plates, which give the funnels and house flags of some of the principal steamship lines in American trade, flags of all nations, and the flags and pennants used in the International Code. These plates are printed in eight colors, and are an attractive feature of the book.

A square foot of uncovered pipe, filled with steam at 100 pounds pressure, will radiate and dissipate in a year the heat put into 3,716 pounds of steam by the economic combustion of 398 pounds of coal. Thus, 10 square feet of bare pipe corresponds approximately to the waste of two tons of coal per annum.

SCIENCE NOTES.

A primitive chart prepared by the Polynesians to assist them in their travels from island to island has been acquired by the British Museum. The chart in question refers to the Marshall Islands, and was prepared by the natives. Routes, currents, and prevailing winds are represented by pieces of split cane, straight or bent according to the chart-makers' knowledge of the facts of the case, while the islands are indicated by univalve shells attached to the canes.

The heat of fusion has been studied by A. W. Smith. (Phys. Rev.) In the determination of the constant the ice in small pieces was previously cooled several degrees below 0 deg. C., and after weighing was transferred to the calorimeter containing kerosene oil already cooled to the same temperature. Heat was supplied by means of an electric current, the amount of heat being calculated by measuring both the current through the coil in the calorimeter, and the E. M. F. between its terminals, in terms of a standard cell. The preliminary value given for the constant is 334.25 joules as the mean of eight determinations of the heat of fusion of ice, in each of which about 100 grammes of ice was melted.

On passing a current of hydrogen through a silica tube heated until soft in an oxyhydrogen flame, a deposit of silica, either alone or mixed with silicon, is formed in the tube, the silica being reduced by the hydrogen forming silicon hydride and water vapor, which react together in the reverse direction at a slightly lower temperature. When, however, this reverse reaction is incomplete, some of the silicon hydride is decomposed, yielding silicon and hydrogen. A silica rod loses weight when heated in an oxyhydrogen flame, a rod 970 milligrammes in weight losing 500 milligrammes in 15 minutes. That the above-described deposition of silica and silicon is not due to the volatility of the silica and its partial dissociation is proved by Moissan's work, which showed that silica is not appreciably volatile at the temperature of these experiments. Further, if oxygen or carbon monoxide is passed through the silica tube in place of hydrogen, no deposit forms. The loss in weight of the silica rod when heated varies with the nature of the gas employed as source of heat, being greatest for a mixture of oxygen and hydrogen, and least for oxygen with carbonic oxide.

On immersing in cold distilled water a rod of one of the four non-crystalline tin-aluminium alloys, Sn_5Al, Sn_3Al, Sn_2Al, and $SnAl_3$, the surface of which has been worked with the file, an abundant evolution of detonating gas takes place for two or three minutes at the field surface of the alloy. This phenomenon is not observed with (1) a previously heated or filed tin or aluminium rod, or (2) a rod of the alloy not filed but heated to the same temperature as is produced by the filing. These tin-aluminium alloys must be formed, except at the hardened surface, by the juxtaposition of the molecules of the two metals, so that the filed surface acts with the distilled water like a number of small thermo-electric couples which immediately decompose the water. Boiling distilled water is decomposed by the non-filed tin-aluminium alloy, the heating apparently destroying the combination of the metals at the surface. If a filed tin-aluminium rod is dipped into a faintly acid copper sulphate solution, oxygen is evolved and copper deposited; a non-filed tin or aluminium rod, however, precipitates the copper but gives no gas evolution. Zinc sulphate behaves like copper sulphate, but the development of oxygen is not so vigorous.

Lead-aluminium alloys are described by H. Pécheux in Comptes Rendus. Molten mixtures of aluminium and lead, containing less than 90 per cent of the former metal, separate, on cooling, into three layers, the lower one consisting of lead, the middle one of an alloy containing 90 to 97 per cent of aluminium, while the upper one is aluminium. Of the alloys obtained in this way, those containing respectively 93, 95, and 98 per cent of aluminium have the densities 2.745, 2.674, and 2.600, and have nearly the same color as aluminium; they are malleable and are readily cut with the chisel, showing a silvery surface, but are not so hard as aluminium and are easily bent. That they are not definite compounds is shown by the fact that, when re-melted and cast, they yield alloys containing 92, 94, and 96 per cent respectively of aluminium and having the densities 2.765, 2.691, and 2.671. This tendency to liquate necessitates the rapid cooling of the molten alloys. The alloys do not oxidize in moist air or in the molten state. They are attacked at ordinary temperatures by concentrated hydrochloric or sulphuric acid with evolution of hydrogen, and by hot sulphuric acid which evolves sulphur dioxide and by hot nitric acid with generation of nitric oxide; the latter acid has little action in the cold, and the same is the case with dilute acids, even when heated. Concentrated potassium hydroxide solution and aqua regia act vigorously even in the cold, but distilled water is without action even at the boiling point; hydrogen sulphide blackens to a slight extent the alloys containing 92 and 93 per cent of aluminium.

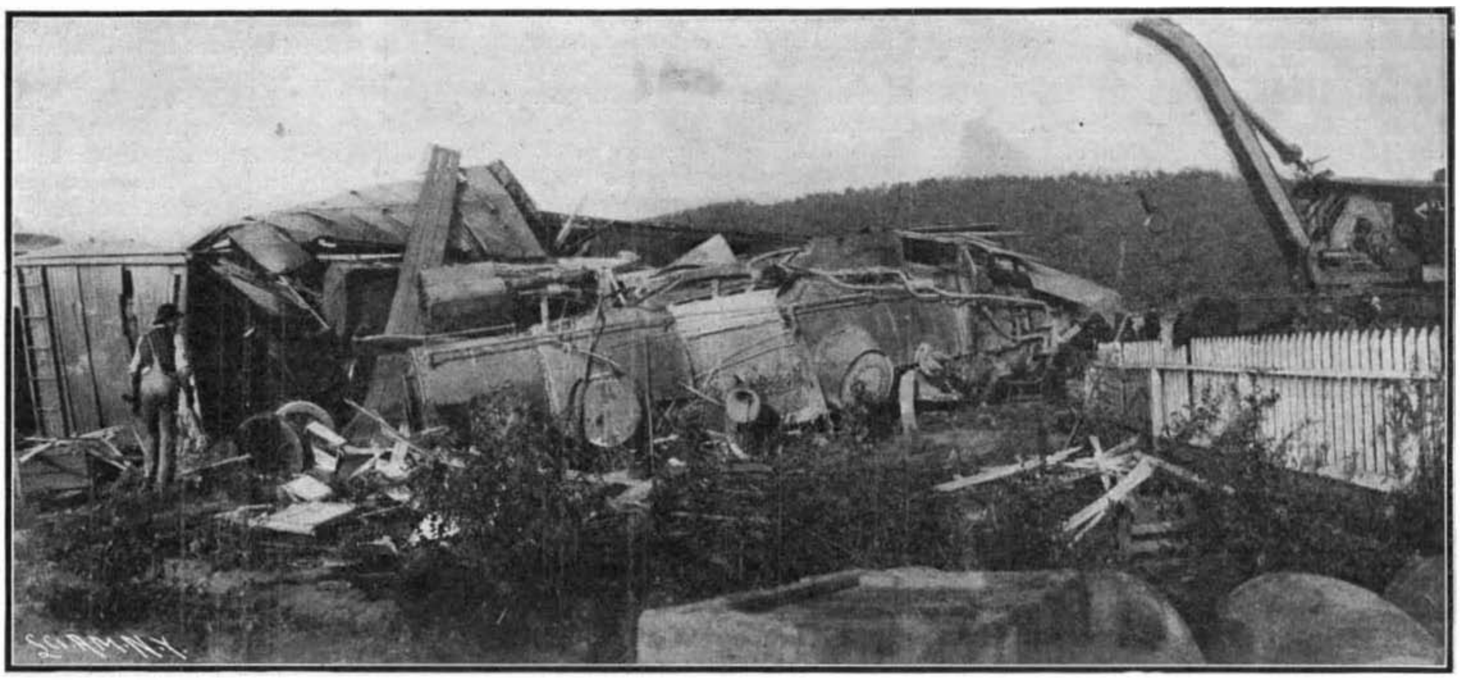
TRAIN WRECKED BY COLLISION WITH DYNAMITE.

BY W. L. RADCLIFFE.

On Friday afternoon, September 23, just as an east-bound freight on the Baltimore & Ohio Railroad was approaching North Branch, a little station five miles east of Cumberland, Md., a teamster with a two-horse wagon, hauling a load of 800 pounds of dynamite, attempted to cross the track. Unfortunately his team was just a trifle too slow, and the on-rushing locomotive struck the rear end of the wagon, hurling it nearly a hundred yards along the track. The terrific explosion almost totally demolished the nine houses in the little hamlet, threw the heavy locomotive a hundred feet from the track, completely turning it around, and reduced seven loaded freight cars to kindling wood in a twinkling of an eye. One of the brakemen was instantly killed; seven other persons were seriously hurt, and the engineer, one of the oldest and most skillful employes of the Baltimore & Ohio, was found in the demolished cab of his engine unconscious, with the scalding steam and water pouring over him, but still firmly gripping the throttle. He died while being removed to the hospital.

The signal tower, in which were the Baltimore & Ohio operator and his brother, was completely wrecked, and its occupants were badly cut by the glass and splinters.

The windows of nearly every house within half a mile of North Branch were shattered; while the explosion was plainly heard and the concussion felt in Cumberland, five miles distant. Strange to say, the horses which were attached to the ill-fated wagon were not injured at all. The driver was rendered unconscious by the explosion, but received no other injury. The wagon was totally annihilated, and the only part of it which could be found was a tire from one of the wheels, which was discovered wrapped as tightly around a neighboring telegraph pole as though fastened there by a blacksmith. The dynamite was being hauled to the camp of McArthur Brothers, who are constructing a portion of the Wabash Railroad. Their commissary department, offices, and hospital were badly wrecked. Considering the great destruction of property caused by the catastrophe, it seems almost a miracle that the loss of life was so small.



TRAIN WRECKED BY COLLISION WITH DYNAMITE.

TESTING MACHINES AT THE BOSTON INSTITUTE OF TECHNOLOGY.

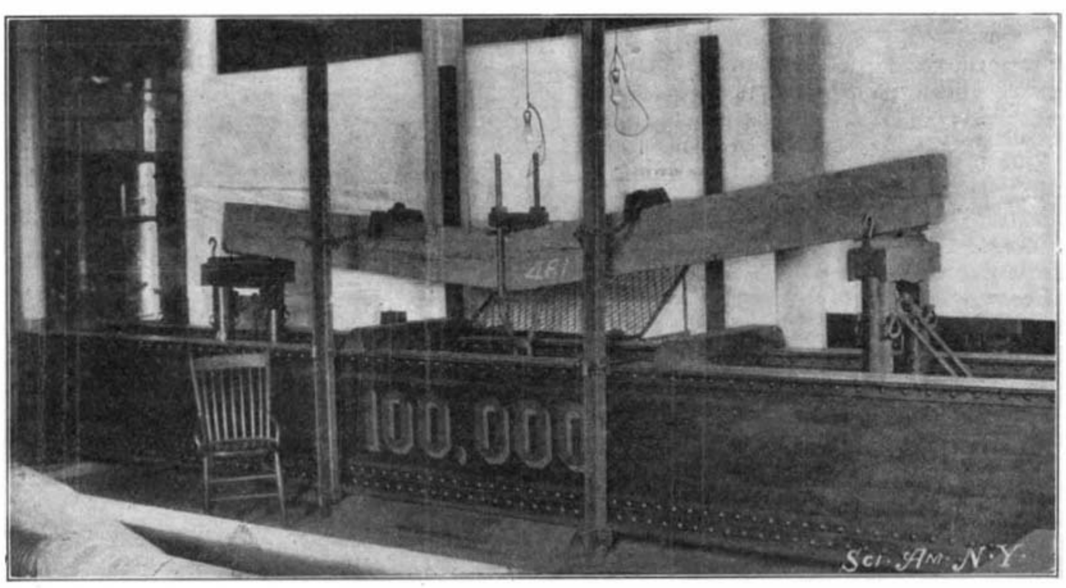
BY DAY ALLEN WILLEY.

Within the last few years some very interesting apparatus has been utilized at the Massachusetts Institute of Technology, to determine the strength of materials when subjected to strain under various conditions. The installation of this machinery originated with Prof. Gaetano Lanza, who has been conducting such experiments for a period of years. Prof. Lanza at first made tests with small pieces of wood, iron, and other substances. His experiments were attended with such success that it was decided to work with material of sizes regularly utilized in building and other operations, such as wooden beams, arches, columns of brick and stone masonry, and shafts and pillars of iron and steel. The different tests, which are applied by means of the apparatus now in use, are to determine the tension, compression, transverse strength, torsion, impact, and repeated stress.

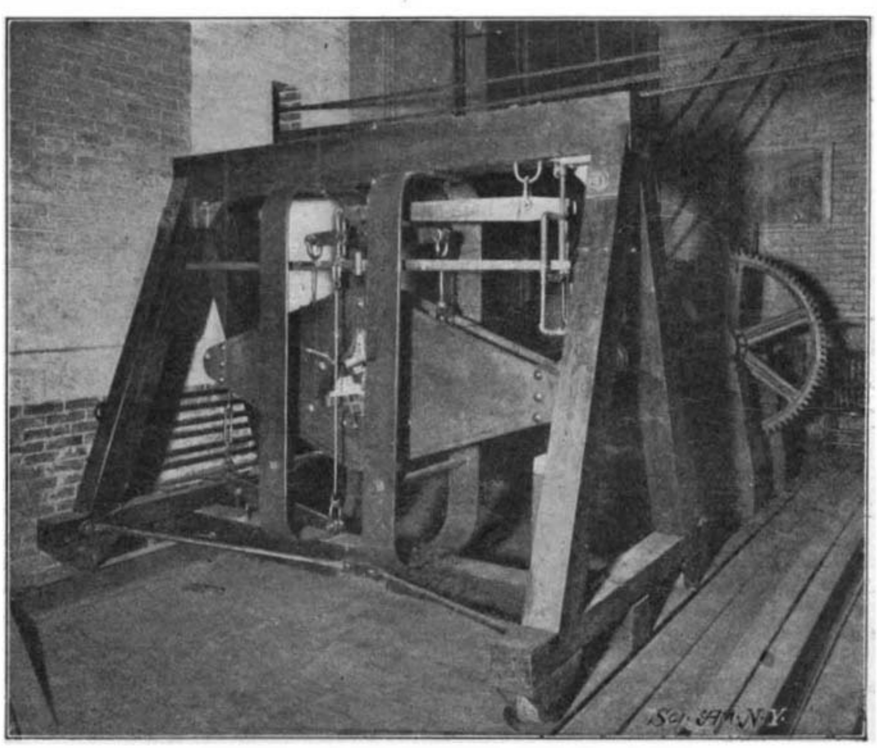
For the purpose of determining the strength of masonry in various forms, the test laboratory is equipped with an arch-testing machine, representing a capacity of 400,000 pounds. It can be utilized in connection with an arch having a maximum length of ten feet and a minimum rise of one in ten. As is indicated by the photograph, the machine consists of a framework of eye-beams and plate girders, through which pass a series of rods. The testing load is applied by two hydraulic rams, each of 100 tons capacity. The upward reaction of the rams is against a system of scale levers, which weigh the load. The downward force of the rams is taken by the series of two-inch steel rods, which pull down on the I-beams, used to distribute the load to the blocks. The latter are of wood, one foot in length and of a width proportionate to the size of the arch, being fitted to its top. The thrust of the arch is measured by noting the extension of four of the three-inch steel rods. These have been tested, and the moduli of elasticity determined, so that each rod indicates the load it is carrying by measuring its stretch. This stretch is measured to one ten-thousandth of an inch in a length of one hundred inches. The casting at the right hand of the machine rests on the I-beam frame. The left-hand casting, against which the arch bears, is mounted on rollers 17½ inches in diameter, so as to allow the three-inch rods to stretch to the extent required. The photograph shows the machine in operation with an arch of brickwork.

The principal transverse test-

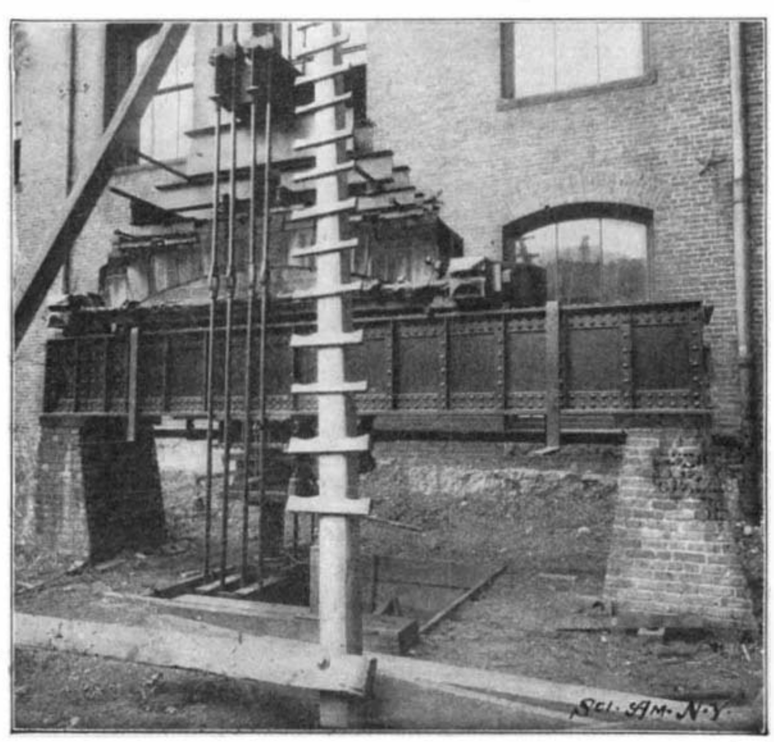
(Continued on page 282.)



TRANSVERSE TESTING MACHINE; CAPACITY, 100,000 POUNDS.



MACHINE FOR TESTING TORSIONAL STRENGTH.

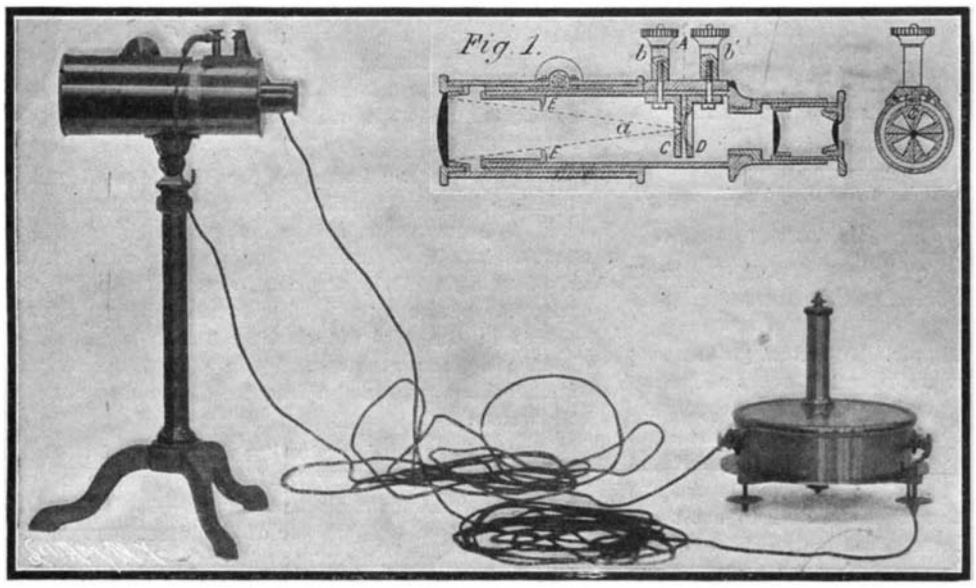


ARCH TESTING MACHINE; CAPACITY, 400,000 POUNDS.

THE FÉRY PYROMETRIC TELESCOPE.

BY DR. ALFRED GRADENWITZ.

A pyrometer the range of which is practically unlimited, has recently been designed by Prof. Ch. Féry, of the Paris Ecole de Physique et de Chimie. The underlying principle on which the apparatus is constructed, is the law regarding the relation of the thermic radiation of heated bodies to their proper temperature as enunciated by Stefan as far back as 1880 and confirmed by the researches of Prof. Boltzmann and other physicists. The problem solved by Stefan seemed for a long time a rather complicated one, as the emissive power of solids is itself in most cases an unknown function of the temperature, which further complicates the relations observed. The problem, however, is simplified in a high degree when considering the so-called *black bodies*. The notion of "black bodies," as first introduced into science by Kirchhoff, is relative to a body emitting, when heated, any kind of radiation in normal proportions; carbon and a large number of black metallic oxides will show this behavior. The theoretical notion of the "black body" is however best realized in practice by a large sized furnace, possessing only a very narrow opening through which the radiations are allowed to pass. Any body heated, not in the open air but in a large closed furnace, will accurately show the normal radiation of black bodies quite independently of the nature of the walls of the furnace. Now as a similar heating process is mostly used in industrial practice, an instrument based on the behavior of black bodies would seem to be highly suitable for industrial purposes. This behavior of black bodies is indicated by Stefan's law as follows: The amount of heat radiated from a black body (or from the opening of a furnace) brought to a high temperature, is proportional to the fourth power of the absolute temperature of the black body (or the furnace).



THE FÉRY PYROMETRIC TELESCOPE.

The instrument designed by Féry on this principle is represented diagrammatically in Fig. 1. The cross wires of a telescope, the objective of which is made of fluorine (a substance highly transparent to any radiation and the presence of which does not alter to any appreciable degree the composition of the radiation), are replaced by a system of two narrow and extremely thin plates of iron and constantan* respectively soldered to one another at their points of intersection and fixed by their ends to two brass disks, *C* and *D*, from which the electric current is taken through the binding posts *b* and *b'*. This system obviously embodies a thermo-electric couple. The attachment is readily pointed at the hot body, while being independent of any lateral stray radiations; in fact, on the tube of the telescope being heated, the temperature of all the soldered seams of the thermic battery constituted by the two metallic plates will be increased by equal amounts without any disturbance in the readings being produced. In order to limit the length of the plates submitted to the thermic radiation, a cross-shaped screen has been added, allowing only the soldered seam to be exposed; finally a diaphragm, *E*, placed at a constant distance from the cross-wire plates, makes the readings independent of the distance at which the body is placed. The angle, *a*, of the cone of rays striking the soldered seam will accordingly be independent of the length to which the tube of the telescope has been drawn out.

The telescope is, by means of a flexible wire of a known resistance, connected to a special galvanometer by the deflection of which the energy of the radiation is indicated. Experiment goes to show that the relative absorption of fluorine becomes constant from the temperature of 900 deg. C.; that is, the amount of heat absorbed then bears a constant ratio to the amount of heat transmitted. A telescope standardized at a temperature upward of 900 deg. C. will therefore allow of ascertaining immediately the unknown temperature corresponding to an observed radiation.

If, for instance, the deflection obtained on the transparent scale of the galvanometer be 75 mm. in case the furnace the telescope is pointed at is at a temperature of 1,000 deg., and 300 mm. be the deflection due to a body brought to a temperature *x*, then Stefan's law will give immediately

$$\frac{x^4}{(1000 + 273)^4} = \frac{300}{75};$$

whence $x = 2{,}547$ deg. absolute, or 2,274 deg. C.

As the temperature is proportional to the fourth root of the galvanometric deflection, even a rather large error as to the radiation will result in a much smaller relative error with respect to the temperature. In order to avoid any calculation, the temperature corresponding to the observed deflection may be derived from a curve. There are several diaphragms intended for different ranges of temperature, allowing temperatures included between 800 and 4,000 deg. C. to be readily determined, though the deflection corresponding to the latter temperature be 250 times greater than that observed at 800 deg.

For industrial purposes, the inventor has slightly modified his apparatus, using instead of fluorine lenses, a lens made of a special glass, the opening of which is large enough to insure easy readings on industrial galvanometers. Such pyrometers are standardized by comparison with a fluorine objective pyrometer.

* Constantan is a German alloy of copper and nickel containing 50 per cent of each.

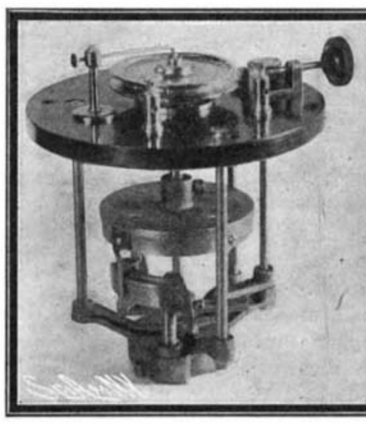
A NOVEL INTERRUPTER FOR INDUCTION COILS.

BY OUR BERLIN CORRESPONDENT.

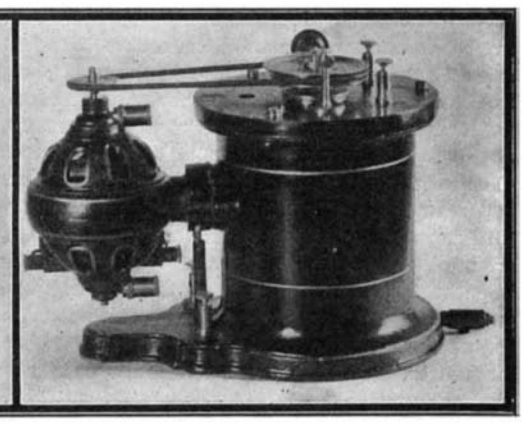
Ever since induction coils have obtained their present importance in connection with Röntgen rays and wireless telegraphy, there has been a demand for a reliable interrupting device, which can be regulated to give any desired frequency and any desired duration of the current impulses.

This demand is greater in connection with Röntgen apparatus, as Röntgen bulbs have to be regulated during operation, to give most favorable results. On the other hand, such interrupters have to work with a low consumption of energy and the bulbs must be put to as low strains as possible.

The Wodal mercury jet interrupter, which we illustrate herewith, fulfills these requirements in a very satisfactory way. The main casing carries at one side a small electric motor, which drives a shaft located centrally in the interrupter proper. This shaft comprises two sections coupled together but electrically insulated from each other by a disk of hard rubber. The upper member of the coupling consists of a circular metallic plate formed at its periphery with a flange which fits over the insulating disk. A number of contact fingers depend from this flange. Attached to the lower end of the shaft is a centrifugal device which operates in a quantity of mercury which fills the lower portion of the main casing. The mercury is thereby constrained to rise through a pipe to a perforated, curved casing whence it flows out in a broad jet in the path of the revolving contact fingers. Every time a finger encounters this jet, the electric circuit is completed to the induction coil. A shield which fits over the perforated face of the curved casing may be operated by means of a thumbscrew at the top of the interrupter to close any desired number of the perforations, thus permitting the width of the mercury to be adjusted. When the holes are all open, the contact fingers will encounter a broad ribbon jet, and a maximum duration of current impulses will be obtained; on the other hand, in the case of a single hole being opened, the impulses will be of short duration, and the current may



The Interrupter with Casing Removed.



The Interrupter Complete.

A NOVEL INTERRUPTER FOR INDUCTION COILS.

Fig. 1.—Street Post.

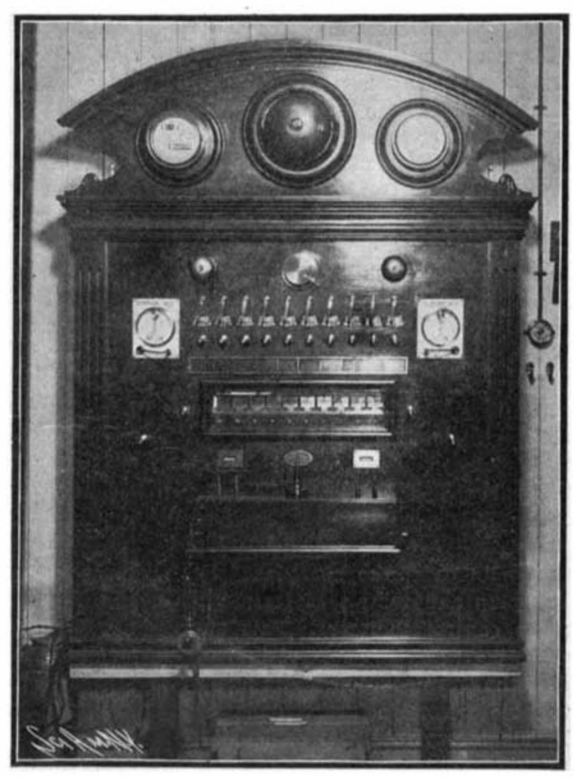


Fig. 2.—Fire Alarm Switchboard.

A NEW ENGLISH TELEPHONIC FIRE ALARM.—[See next page.]

be wholly switched off by covering the last hole. The path followed by the current in the Wodal interrupter is as follows: The current is supplied to the motor through a variable resistance allowing regulation of the number of revolutions of the motor and, hence, the number of interruptions being readily altered. No special regulating resistance is necessary for the primary of the induction coil, even the most delicate regulation of the current supply being secured by means of the interrupter itself. The Wodal interrupter, like other interrupters, is inserted between the source of current and the primary of the induction coil, the current being conveyed to the mercury jet, and thence through the contact fingers and revolving shaft to the induction coil.

In order to insure more rapid interruptions with a minimum sparking, the reservoir is filled with a quantity of petroleum. As compared with electrolytic interrupters, the Wodal affords the advantage of being perfectly noiseless in operation, and of consuming very little current (about 1½ to 3 amperes). It can be used with any high-tension direct currents.

A NEW ENGLISH TELEPHONIC FIRE ALARM.

BY FRANK C. PERKINS.

A new English system of street fire alarms has recently been brought out by the General Electric Company, Limited, of London, which comprises street alarm and telephone posts located at various points in the city and an annunciator switchboard for the fire station, as shown in the accompanying illustrations, Figs. 1 and 2. As usual the functions of the post are to act as fire-alarm pulls to be operated by the public in the event of fire and to serve as street telephones for the use of the fire brigade in executing their duties, while they may also be employed if desired as police telephones.

The calls are received from the street posts by the annunciator switchboard, which indicates from which post the call is given. The function of the annunciator switchboard is also to discriminate between genuine and accidental calls, such as "grounds"; to allow the lines being tested; and, where required, to serve as a switch for connecting any street post with the police station, or with any official on the system.

The post is fitted with a locking pull to be operated by the public, a vibrating bell, which rings when the pull is operated and indicates that the call is passing through the station, while the stopping of the bell indicates that the call has been attended to. A replacement movement for the pull is provided, as well as the usual telephone receiver, water type microphone transmitter, and induction coil. There is also provided the usual automatic switch hook, call key, lightning arrester, and a two-microfarad condenser which is used in the line test.

The switchboard at the fire station noted in the illustration, Fig. 2, includes an annunciator drop and jack for each post, an 8-inch alarm bell, and an answering plug, also a control indicator, enabling a line which has been used to be kept under observation until the pull in the post is replaced. A control bell gives an audible signal when the pull in the post is replaced, and a discriminating buzzer is provided to allow of determination between real and accidental calls. In addition to the hand combination telephone and magneto generator for the purpose of testing the lines and when required to call any department, a perpetual calendar is provided, as well as an English timepiece, as noted at the top of the switchboard. The Tottenham Urban District Council has installed this system of electric fire alarms, as shown in the accompanying illustration, with thirty-five fire-alarm posts, each fitted with a telephone plug box. When the pull in the post is operated, the battery current passes through the indicator drop, closing the local alarm bell circuit, and the bell in the post at the same time rings.

The fireman attendant in the watchroom inserts his answering plug in the spring jack underneath the fallen shutter, and the discriminating buzzer at once emits a loud buzzing sound. If the alarm were caused by "ground" on the line, the buzzer would not operate, and the brigade would not be called out unnecessarily.

If, on inserting the answering plug, the discriminating buzzer does not operate, it indicates either that someone wishes to telephone, or that the line has become earthed and requires attention. The attendant can ascertain which by listening on the telephone and making the usual inquiries.

After calling out the brigade, the attendant withdraws the answering plug and inserts in its place a plug belonging to the control indicator. This stops the bell ringing in the post, and the control indicator pointer is deflected to the "on" position. The answering plug is now available to receive further calls.

When the post-handle is replaced, the control indicator returns to the "off" position, and the control bell rings continuously until the plug is withdrawn and placed in its normal position. The attendant now inserts his answering plug and listens on the telephone to ascertain if the person replacing the pull wishes to speak to him.

To test the lines from the station, the answering plug is inserted in each spring jack successively and the generator handle turned. If the line is in proper order the discriminating buzzer will be actuated, but if the line is discontinuous, it will remain silent.

At the post, if it is required to speak to the fire station it is only necessary to hold the receiver to the ear and press three or four times on the small push button for the purpose.

TESTING MACHINES AT THE BOSTON INSTITUTE OF TECHNOLOGY.

(*Continued from page 280.*)

ing machine in use at the Institute is of 100,000 pounds capacity, and will test specimens of material up to 26 feet span.

The machine is quite simple. Two steel girders rest at the center on a framework raised 4 inches above the floor. These girders support two movable carriages, which hold the jackscrews used for applying the load. At the center of the machine there are three levers used in weighing the load. Two of these levers are beneath the girders of the machine, and do not show in the cut. The main lever gives a multiplication of 10 to 1. It is of steel, about 6 feet long, and at the larger end it is 13 inches deep and 2¼ inches thick. The load is applied by raising the jacks at the ends of the specimen, and it is weighed through the pull exerted on the levers by the yoke attached to the center of the specimen. The steel girders forming the bed must carry, without undue fiber stress, the maximum load which the machine can exert.

The photograph shows a white pine beam which had been in service at least seventy-five years. The stick is 15 inches deep and 15⅞ inches wide. The span was 20 feet. In the test made on this beam in the testing machine, the load was applied at two points, 1 foot either side of the center. The manner of distributing the load is shown by the beams at the center of the machine. The deflection of the beam was measured in the following way: On either side of the beam a fine steel wire was stretched over pins driven into the beam directly above the supports and at the center of the depth. A ten-pound weight on the end of each wire kept the wire in tension. A micrometer was fastened to each side of the beam at center of the length and depth of the specimen. The faces of the micrometer screws were set parallel with the wires, the screws being perpendicular. To take a set of readings, the screws were turned down till contact was made with the wires.

In determining the torsional strength of substances, three machines are utilized by the students, being of 150,000 inch-pounds, 60,000 inch-pounds, and 6,000 inch-pounds capacity. The accompanying photograph is of the most powerful machine.

The specimens commonly tested in it are from 1½ inches to 2½ inches in diameter and of lengths varying from 3 to 12 feet. The power end of the machine is driven by a 4-inch belt running from a countershaft overhead. The gear is keyed to a 4½-inch diameter steel shaft, which turns once in about fifteen minutes. The holder is a massive piece of cast iron, reinforced by two bands of wrought iron three inches wide and one inch thick, shrunk on the outside. The grips are made of cast iron, faced with cast steel which is fluted on the outer surface. These grips are cams which tend to bite the specimens harder and harder as the twisting head turns to the right. The grips do not require a shouldered specimen. Steel bars 1½ inches in diameter, containing 1.10 per cent carbon, have been gripped without the least difficulty. A handwheel is attached to the driving shaft, so that any desired twisting movement may be held on the specimen. This is also used in adjusting the load accurately, when the angle of twist of the specimen is being noted.

The weighing end is held in a movable carriage which runs on I-beam tracks. A casting, with grips similar to those described above, is attached to a hollow frame made of boiler plate, which is hung from the carriage by an equal-arm lever and links, all turning on hardened steel V-shaped knife edges. From a knife edge at each end of this frame a link runs to a lever, one lever being near the top of the carriage and the other near the bottom. The free ends of these levers connect with the weighing beam shown running across the carriage. As the power end holder turns toward the right, the twisting movement, transmitted through the specimen, will tend to rotate the frame so as to cause the right-hand end to go down and the left-hand end to go up. This causes the free end of the weighing beam to lift, and poise weight must be moved to the right to bring this lever level again.

Two processes, dependent upon the fact that some oils, when brought into contact with finely-crushed ore in water, have the remarkable power of absorbing the particles of certain minerals to the exclusion of others, have been developed.

Engineering Notes.

In Belgium about 85 per cent of the navigable waterways are under the direct control of the state, which is also a large shareholder in the canals conceded to private companies.

Stamped sheet zinc is rapidly coming into use for metal ceilings in places where wood has heretofore been used. In some cases the material is even copper-plated and given a beautiful finish. Those who have had experience with other material will readily appreciate the advantage of using zinc.

Overhead electric trams on the Madeleine-Colombes line have been responsible for an extraordinary accident. The conductor, at the end of his journey, was about to turn the arm from front to rear when, in the act of swinging it by the cord, something caused the springs to act as a powerful catapult, lifting the man 18 feet in the air and hurling him a considerable distance on the roadway. When picked up he was found to have sustained a fracture of the shoulder and both wrists.

A method proposed for testing wood treated to resist fire consists in suddenly heating ½ gramme of the wood by means of an electric current—120 volts, 7 to 10 amperes—to a temperature of 700 to 800 deg. C., and measuring the volume of gas liberated in the course of two minutes. The wood is contained in a platinum wire basket, and the weight of ash and charcoal left can also be determined. A good sample should yield a smaller volume of gas and a larger weight of ash than an untreated sample.

The French Admiralty has quickly recognized the possibilities of the gasoline motor for the propulsion of small war vessels. A vessel intended for police purposes upon the rivers in the French Congo has been launched from Bangui, built under the supervision of the Admiralty, and fitted with two 30-horse-power gasoline engines. The boat is 97 feet 6 inches in length, and is armed with quick-firing guns. It is the largest gasoline-propelled boat that has yet been constructed in France and is purely an experimental vessel to demonstrate the capabilities of this type of engine for small craft of this type.

In Umea, Swedèn, there has recently been installed a factory for the dry distillation of wood, by means of superheated steam, where, in addition to wood coal, wood tar and turpentine oil are recovered. According to the process invented by Mr. Elfström, the steam, superheated to some hundreds of degrees, is conveyed into a tightly-closed horizontal retort of a capacity of 15 cubic meters, filled with resinous wood, when the wood tar, mixed with condensing water, is deposited on the bottom of the latter, the volatile portions being removed with the steam generated by the moisture of the wood. On their way, they are once more highly superheated, and are allowed to exert their effect in a second similar retort. The water vapors, strongly saturated with turpentine oil, are eventually condensed, the turpentine oil being separated readily from the water, while the combustible wood gases are being used for heating the steam producer and the superheater. The wood-tar discharged from time to time from the retort is separated by an addition of common salt from the condenser water, the density of which is thus increased to such an extent as to cause the tar to accumulate on the top. The process is said not only to afford a large output of wood coal, but in addition, wood-tar and turpentine oils of far greater purity than in distillation plants with immediate retort firing, the process being much more uniform in the retorts and too high retort temperatures being avoided.

The Current Supplement.

The current SUPPLEMENT, No. 1503, contains an unusual variety of interesting scientific articles. Mr. Joseph Horner describes at length, in an excellent review, modern methods of steel casting. His article will be concluded in the next number of the SUPPLEMENT. Many illustrations accompany the text. H. W. Buck, electrical engineer of the Niagara Falls Power Company, outlines in an instructive way the method of utilizing Niagara power. Prof. Holden's splendid appreciation of Copernicus is concluded. It has been suggested (and the theory has received to some extent the support of experimental proof) that certain kinds of insects derive protection from the grotesqueness or hideousness of their appearance; Mr. Percy Collins convincingly proves the theory in an article entitled "Terrifying Masks and Warning Liveries." Numerous photographs of insects accompany his article and bear out his contentions. Just where King Solomon's Mines may have been situated no one knows. In an excellent article published in the current SUPPLEMENT, the location of this fabled land of wealth is given on the basis of modern explorations. Prof. Rutherford's painstaking discussion of the radio-activity and emanation of radium is concluded. Prof. Neesen contributes a valuable paper on "Protection from Lightning." The usual notes are likewise published.

Correspondence.

Effect of the Sun's Rays on the Black Race.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of August 20, Prof. Edwin Grant Dexter claims that nature made a mistake in putting the black race in the hot portions of the earth, because black is a better absorber of heat than white.

Let us look at the facts. In the white man the epidermis is a nearly colorless, translucent membrane, while in the black man it is made opaque by the deposit of pigment granules in its lowest layer of cells. Then practically the difference between the two kinds of epidermis is the same as that between a sheet of clear, colorless glass and a sheet of smoked glass; that is, a sheet of glass one side of which has a coating of lampblack. Compared with clear glass, smoked glass is impervious to the sun's rays.

It is to protect the delicate tissue cells of the body from the destructive influences of the heat and chemical rays of the sun that nature has blackened the epidermis of the inhabitant of the tropics.

When we add that the radiating power of the blackened epidermis is relatively as high as its absorbing power, we think that we have proved that nature can be rightly read.

JAMES S. MAHER,
Health Commissioner of New Haven, Conn.

September 3, 1904.

FIRST COMPETITION FOR THE VANDERBILT INTERNATIONAL AUTOMOBILE CUP.

The one-thousand-dollar international cup, which was recently presented by Mr. William K. Vanderbilt, Jr., to the American Automobile Association for annual competition, was the subject of a most interesting and successful contest, which came off on October 8, on a specially-selected course on Long Island. The donor of the cup was one of the first to import an automobile into this country; he has raced in important international contests abroad, and his object in the presentation of the cup was to promote long-distance road races of this kind, under the conviction that by this means, more than by any other, the development of the very finest design and workmanship can be promoted in the automobile industry in this country. The cup, which is a handsome silver trophy, stands, with its base, about 31 inches in height, and contains 481 ounces of sterling silver. The deed of gift requires that the contests during 1904 and 1905 must be held on American soil; and the competitions of 1906 and subsequent years may be held in the country whose representative club shall have won the cup during the preceding year.

The course is in the form of an isoceles triangle, with two long sides and a short base, the base measuring about 5 miles, and the two sides about 12½ miles each in length, making the total length of the course 30.24 miles. The apex of the triangle is at the western end of the course, at the town of Queens, and the angles of the base are at the village of Jericho and where the Jericho road makes a right-angled turn into the road to Hempstead. There was no limit placed upon the speed of the contestants except at two controls, one at the town of Hicksville, where the course crosses the Long Island Railroad, and another through the village of Hempstead. The first control was 0.4 mile in length, and the automobiles were required to take three minutes in passing through the same. The other control was 1.4 miles in length, and the time of passing through it was to be six minutes. The starting point and finish of the race were on the northern leg of the triangle, at a point about 3 miles from the town of Jericho. Following the direction of the course there was, first, a run of 3 miles at high speed to this turn, which had to be taken at a speed of from 10 to 15 miles an hour; then a stretch of about 2 miles to the Hicksville control, followed by a run of three miles to the turn from the Hicksville into the Hempstead road, after which there was an uninterrupted high-speed run of about 6 miles to the Hempstead control, followed by a fast 5-mile stretch to the sharp turn at the apex of the triangle at Queens. After leaving Queens there was nothing materially to check the speed, except for some rather rough surface, until the turn at Jericho was reached. The actual distance of the course, exclusive of the controls, was therefore 28.44 miles, and as this had to be covered ten times, it made the actual racing distance 284.4 miles in length.

The roads thus traversed are typical macadam roads of that part of Long Island, level for the most part, with some slight undulations, and because of the comparatively dry weather were rather heavily coated with dust. In the preparations for the race, however, $5,000 had been expended in oiling the roads, with the result that there was a 10-foot racing track in the center of the road that was free from dust, hard, and fairly smooth. Some work had been done in smoothing the roads and fixing up the bad spots at turns and grade crossings; but on that portion of the course outside of the controls, that is on the actual race track, there were, in addition to the three sharp turns at the corners of the triangle, two railroad grade crossings and one or two turns and difficult places that required a slackening of the speed. Moreover, with its customary temerity and willingness to take a chance where any excitement is to be had for the risk, the American public crowded on to the course, and in walking from spot to spot to obtain different points of vantage, did not hesitate to use the oiled center of the road for their perambulations. The course was patroled by motor bicyclists bearing the official badge, each patrol covering a mile and a half of the course. Flagmen were also stationed at the cross roads, and it was to these that the public seemed content to trust for warning that a car was coming, when they would scatter, often only a few seconds before a machine would thunder by at from 60 to 85 miles an hour. This condition of things was the fault of the public and not of the promoters of the race, who had presented verbal and written warning to the public to remain at the fence line and not, under any circumstances, come upon the road.

LIST OF COMPETING MACHINES.

ORDER OF START.	MACHINE.	HORSE POWER.	OWNED BY	DRIVEN BY
1	Mercedes Simplex	60	S. B. Stevens	A. L. Campbell
2	De Dietrich	80	De Dietrich et Cie	F. Gabriel
3	Royal Tourist	35	Royal Motor Car Co	J. Tracy
4	Pope Toledo	60	Pope Motor Car Co	A. C. Webb
5	Mercedes	60	Geo. Arents, Jr	G. Arents, Jr,
6	Pope Toledo	24	Pope Motor Car Co	H. H. Lyttle
7	Panhard & Levassor	90	Panhard & Levassor	George Heath
8	Mercedes	60	E. R. Thomas	E. E. Hawley
9	Mercedes Simplex	90	C. Gray Dinsmore	W. Werner
10	Fiat	90	A. G. Vanderbilt	P. Sartori
11	Renault	90	W. G. Brokaw	M. Bernin
12	Clement Bayard	90	A. Clement	A. Clement, Jr.
14	Panhard & Levassor	90	Panhard & Levassor	H. Tart
15	" "	90	" "	G. Teste
16	Packard Gray Wolf	24	Packard Motor Car Co	C. Schmidt
17	S. & M. Simplex	75	F. Croker	F. Croker
18	Mercedes	60	I. Wormser, Jr	J. Luttgen
19	Fiat	90	W. Wallace	W. Wallace

The race was started promptly at 6 o'clock, and the eighteen contestants were sent off at two-minute intervals, with a standing start. It was expected that a speed of between 50 and 60 miles an hour would be realized, and consequently the cars started at 6 o'clock would be due about 6.35, or close upon the heels of the last machine to start—a 90-horse-power Fiat which was dispatched at 6.32, the other Fiat, owned by A. G. Vanderbilt, having failed to start because of machinery troubles. The first of the racers to complete the circuit was Gabriel, on his 80-horse-power De Dietrich. Then came No. 4, a 60-horse-power Pope-Toledo, followed by the first starter, a 60-horse-power Mercedes. The fourth machine was a 90-horse-power Panhard driven by Heath, who had made up 10½ minutes on the leader in the first round, thus giving early evidence that, barring accidents, he would be well up among the leaders at the finish. The fastest time for the first round, and the fastest for the whole race, was made by Teste on another 90-horse-power Panhard, the circuit being made in 24 minutes and 4 seconds, a speed of 70.9 miles per hour for the whole of the racing course, the controls being omitted. When we remember that speed had to be slowed down below 15 miles an hour for the turns, and that considerable time was lost in getting up speed in leaving the two controls, it can easily be understood that on the long stretches of straightaway track, a rate of between 80 and 85 miles an hour must have been reached. Teste contined to maintain his terrific pace for three rounds, but on the fourth round the clutch broke and he was out of the race. Evidently, he was the most daring driver of the eighteen, his speed for the ninety miles averaging about 68 miles an hour. The second best time in the first round was made by Gabriel in 26 minutes, 57 seconds; and the third fastest by young Frank Croker, driving a 75-horse-power Smith & Mabley Simplex, his time being 27 minutes and 35 seconds. Clement, on a 90-horse-power machine of the same name, made the round in 27 minutes, 51 seconds; and Heath, who was destined to win the race, in 28 minutes and 52 seconds. The trouble to tires and mechanism began with the very first round. Wallace, on a 90-horse-power Fiat, broke his clutch and never completed the round; Tracy, on his 35-horse-power Royal, with a bevel gear drive, broke the driving shaft, made temporary repairs, and completed the round in 2 hours, 29 minutes, 45 seconds. The second round was prolific of disaster. The first to complete it was Gabriel, who made the distance in 27 minutes, 14 seconds; and he was followed by Heath in 28 minutes, 18 seconds; Campbell, driving Thomas' 60-horse-power Mercedes, in 28 minutes, 17 seconds; and Teste in 26 minutes, 37 seconds. It was in this round that the first American machine dropped out of the race, the Royal being hopelessly disabled by a cracked cylinder. It was in this round also that the only fatality of the race occurred. The car driven by George Arents, Jr., a 60-horse-power Mercedes, overturned, killing the mechanic and rendering Arents himself unconscious. Early in the first round, in stopping rather suddenly on entering a control, his car swung and hit a tree. On the second round, the tire on the wheel which hit the tree flattened and ultimately flew off. Arents seems to have used the brake again too suddenly, with the result that the car skidded badly, and the combined wrench of the brake and the skidding seems to have torn the rim entirely from the wheel, overturning the car, with the fatal results stated. Outside of this there were no serious accidents throughout the whole race.

In this same round the Mercedes car No. 9 was put out by a cracked cylinder, and the 90-horse-power Renault was disabled by the breaking of the main shaft of the bevel drive. In the third round the fastest time was again made by Teste in 25 minutes and 48 seconds, followed by Heath in 26 minutes, 19 seconds; and Gabriel in 27 minutes, 36 seconds. This round was not marked by any withdrawals. The fourth round saw the collapse of Teste, who was leading by a large margin, his failure being due to a broken clutch. The fastest time was that of Heath (27 minutes, 23 seconds) followed by Hawley in 31 minutes and Gabriel in 33 minutes and 30 seconds as the fastest for the round. By this time Heath had a comfortable lead over Gabriel, who was beginning to experience tire troubles. The fifth round found Heath not only keeping up his fine pace, but gradually increasing it, the round being made in 25 minutes and 13 seconds; the next fastest time was made by Teste in another 90-horse-power Panhard in 25 minutes and 40 seconds. Clement, who before the race had been picked as the winner, a young man of twenty-one years, who was driving a machine made by his father's company, had been having tire troubles earlier in the race, but now was beginning to pick up. He made this fifth round in 29 minutes and 33 seconds.

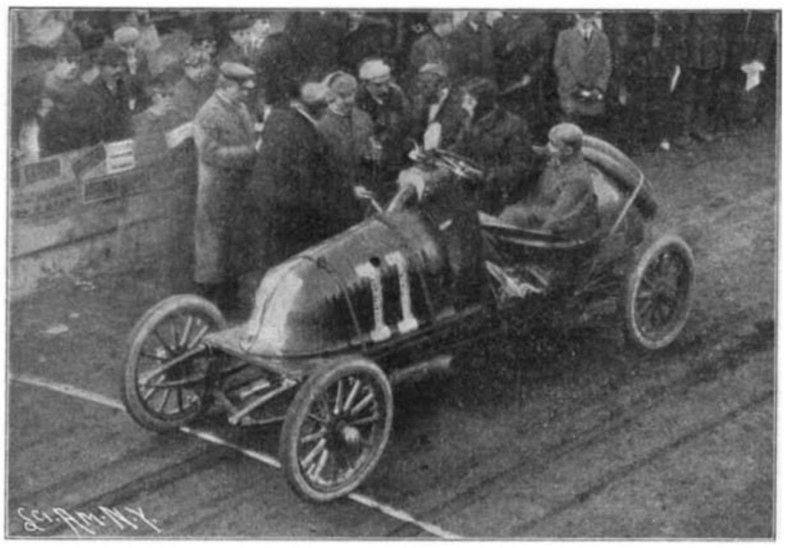
Meanwhile, during the first half of the race, the more moderately-powered American machines had been meeting with varying fortunes. The 60-horse-power Pope-Toledo had trouble chiefly with tires, which threw it hopelessly behind. It did not, however, suffer any permanent breakdown. The little 24-horse-power Pope-Toledo had maintained a remarkably even rate of speed, making the rounds in from 37 to 38 minutes, and with the dropping out of its big foreign opponents, matters began to look promising for its chances. The 24-horse-power Packard machine was doing almost as well; while Croker, in his 75-horse-power Smith & Mabley Simplex, who had made the first two rounds a minute faster than Heath, was making a plucky fight against continually-recurring tire troubles. The fastest time of the sixth round, 31 minutes, was made by Clement who, as the result of a loss of twenty-five minutes by Heath in putting on a new tire, was coming up fast on the leader. In the seventh round, made by Heath in 30 minutes and 5 seconds and by Clement in 30 minutes and 12 seconds, Gabriel, who had been dropping behind in the last two rounds, retired with a broken pump chain. In the eighth round, made by Clement in 33 minutes and 5 seconds, Heath was again delayed by his tires, and took 57 minutes and 27 seconds for the round, thus placing Clement in the lead. From here to the end the race lay between Clement and Heath. At the end of the eighth round, Clement, four minutes ahead of Heath, looked likely to be the winner; but in the ninth and tenth rounds, Heath, in a fine burst of speed, made the circuit in 28 minutes and 52 seconds and 27 minutes and 5 seconds, and managed to come in with a scant margin of 1 minute and 28 seconds, having ridden the whole distance of 284.4 miles at an average speed of 52.22 miles an hour.

The result was decidedly popular, the winner being an American and the car one of the well-known Panhard make. The race was stopped as soon as Clement had passed the line, because of the crowding of the course; but had the race been run out, there is no doubt that the 24-horse-power Pope-Toledo machine would have been third and the 24-horse-power Packard fourth.

Analyzing the race in respect of the nationality of the contestants, we find that of five American cars that started, three finished; of five German Mercedes machines, two finished; of six French machines, two finished, taking first and second place; and of the two Italian machines, one started but did not finish. On

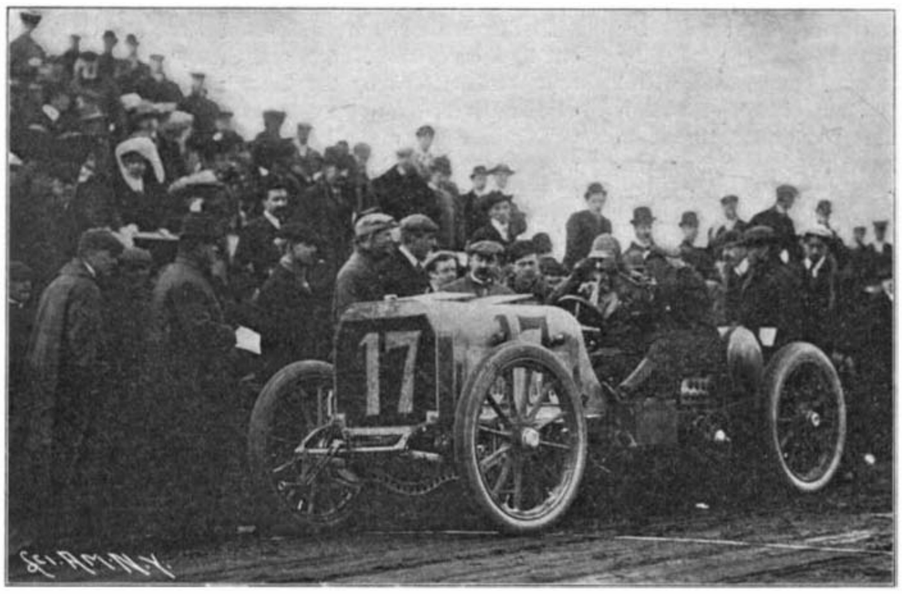
this record, the honors evidently go to the French machines as winners, but on the score of endurance and position, we candidly think that second place is held by America, her machines having taken third and fourth place, and having the highest proportion of machines that finished to those that entered. It is also greatly to their credit that two of the machines that took second and third place were of light weight and moderate horse-power, the Pope-Toledo and Packard machines having only 24 horse-power, while the Smith & Mabley Simplex driven by Croker was still running when the race was called off and would probably have finished.

The study of the causes of partial or permanent breakdown is a very instructive one and valuable to the manufacturer. Of the French machines the 90-horse-power De Dietrich broke its pump chain; the 90-horse-power Renault broke its bevel drive shaft; another Panhard was put out of the running by tire troubles, and another broke its clutch. Of the American machines, one broke its bevel drive shaft, being finally disabled by cracked cylinders; another its steering gear; and the other three had tire troubles. The Simplex machine was found to be over the specified weight, and in order to bring it within requirements, every part of the machine that would stand it, and, as the event proved, some parts that would not stand it, were drilled full of holes. The frame was thereby weakened too much, and sagged so badly that the gear was in danger of striking the ground. Of the five German Mercedes machines, one was wrecked through the collapse of a rear tire, due probably to collision with a tree; another, driven by Hawley, smashed its front springs while turning out of the oiled path in order to pass another machine; the third, a 90-horse-power Mercedes, cracked its cylinders. The one Italian machine in the race broke its clutch.



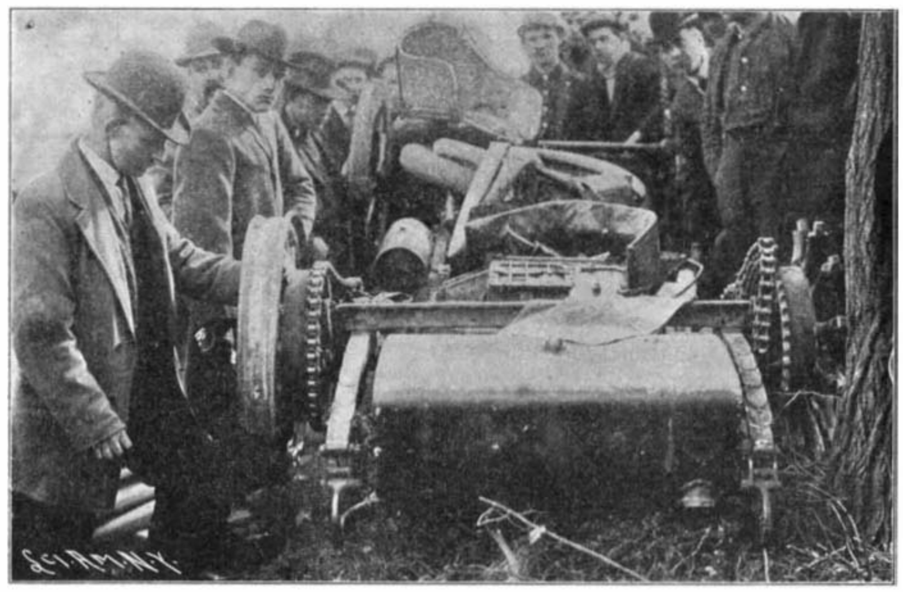
Broke bevel drive shaft in second round.

Start of 90-Horse-Power Renault, Driven by M. Bernin.



Note the drilling out of axle and other parts to lighten machine.

Frank Croker in 75-Horse-Power Simplex.

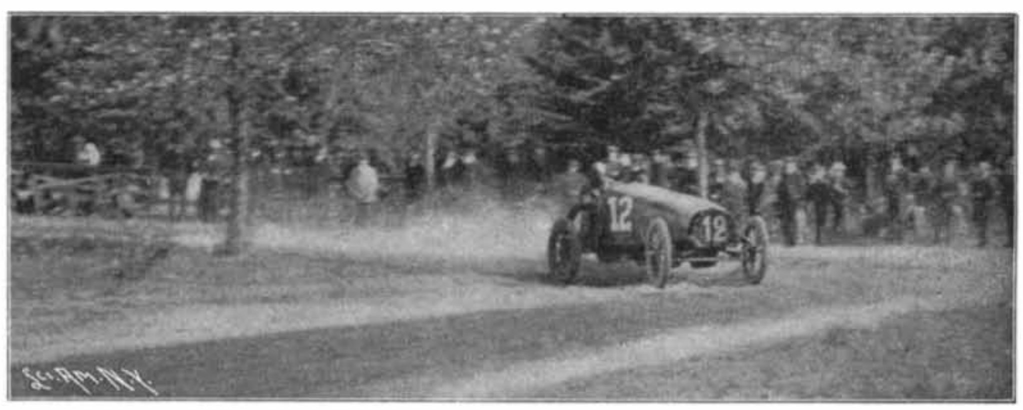


Overturned; machinist killed and Arents injured.

Wreck of Arents' 60-Horse-Power Mercedes.

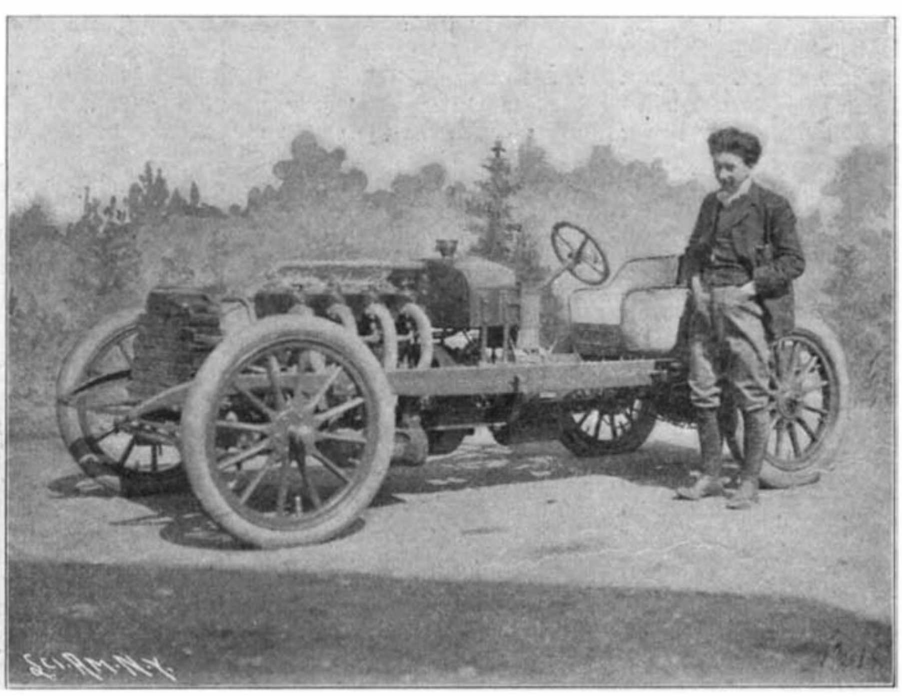
In fourth place at finish.

24-Horse-Power Packard, Driven by C. Schmidt.



Some of these turns were over 90 degrees.

Clement Taking One of the Sharp Turns.



The youngest of the contestants, 21 years old.

Clement-Bayard Machine with Housing Removed, and its Driver, A. Clement, Jr.

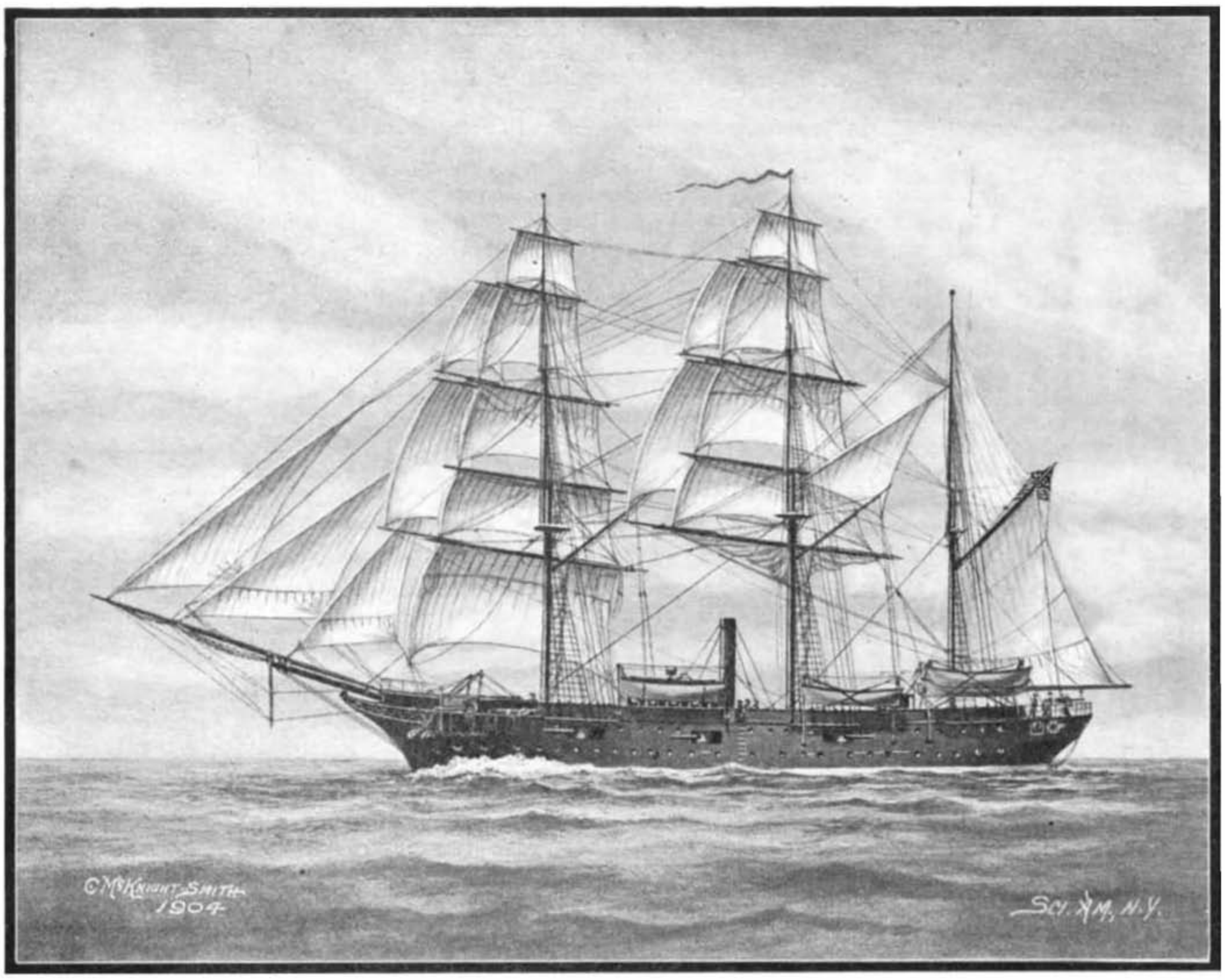
Before the start.

The Winner and His Mechanic.

THE VANDERBILT INTERNATIONAL CUP CONTEST.

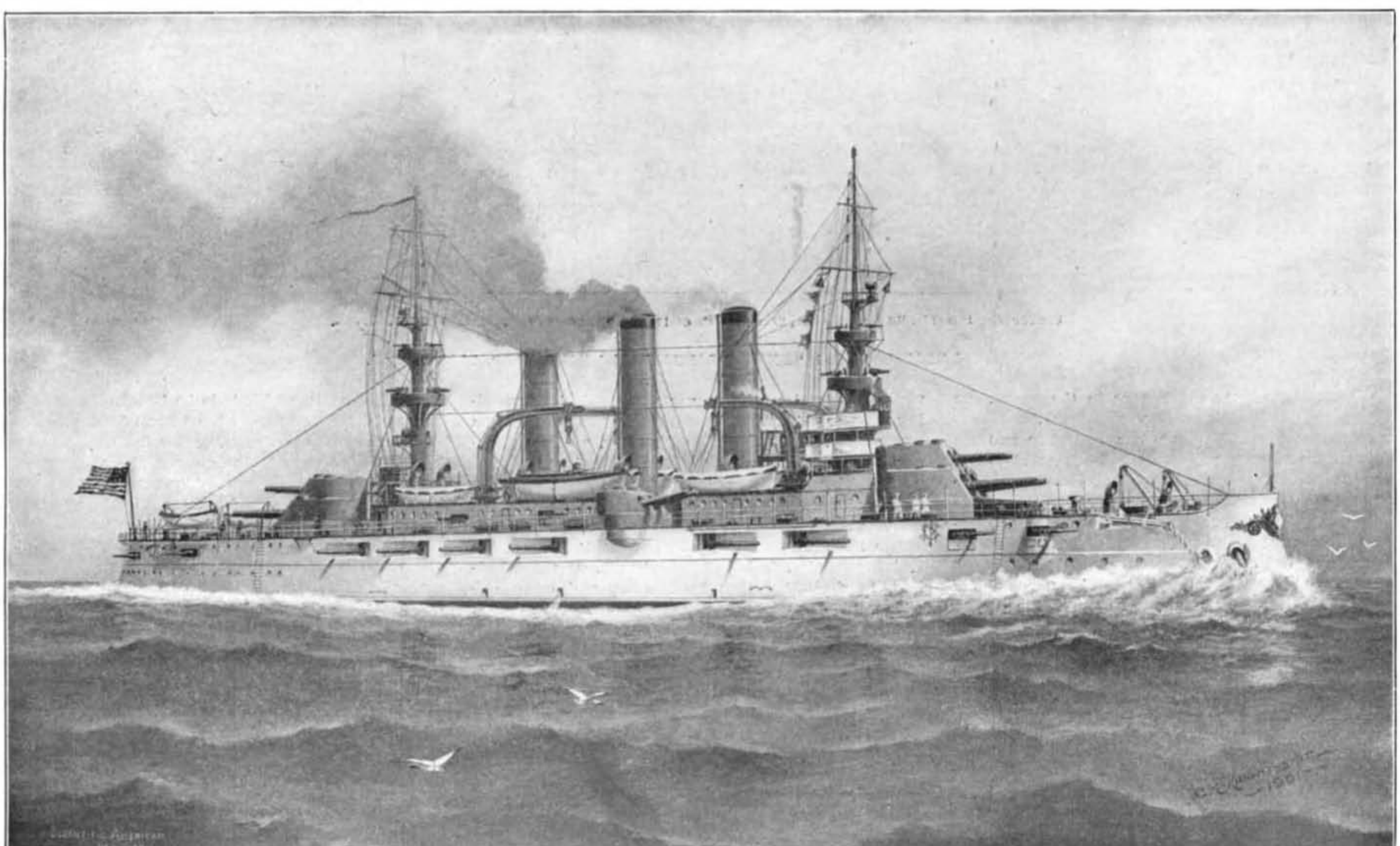
SOME RECENT LAUNCHINGS IN THE UNITED STATES NAVY.

The stimulus given to the private shipbuilding yards by the improved conditions under which contracts for government ships are let, the plans being in more complete condition and less subject to alteration subsequent to the commencement of work than formerly, is showing its good effect in the large number of ships that is now being launched and pushed to completion. Moreover, there is no doubt that the building of the "Connecticut" in a government yard has stirred up the private builders. The rapidity with which the "Louisiana" was built at Newport News is representative of a general quickening of work on government contracts. As immediate evidence of this, it may be noted that, following close upon the launch of the "Connecticut," as recorded in our issue of October 1, another battleship of scarcely less importance, the "Nebraska," was launched the following week at the yard of Moran Brothers, Seattle, Wash., and that on October 11 three United States vessels took the water, namely, the "Georgia," a sister ship to the "Nebraska," which was launched at the Bath Iron Works, Maine; the gunboat "Paducah," a sister ship of the "Dubuque" (whose launch was recorded in our illustrated issue of September 10) launched at Morris Heights, New York; and the wooden training brig "Boxer," which was launched at the United States navy yard, Portsmouth. The Boston navy yard has also recently launched the steel training bark "Cumberland." The launch of the "Georgia" is remarkable from the fact that she went into the water with her masts and smokestacks in place and steam up; something that has never occurred before on a United States warship. The "Georgia" and "Nebraska" represent a class of five ships, four of which, the "Virginia," "Rhode Island," "Nebraska," and "Georgia," are now afloat, while the "New Jersey" will take the water early in November. The description of the "Georgia," therefore, will answer for any one of the class, the differences being of a minor character, and chiefly affecting the displacement, which, in the case of the "Georgia," is estimated at 14,948 tons when she has all stores on board and a normal coal supply of 900 tons. As will be seen from our illustration, this fine ship, which is only about 1,000 tons less in displacement than the "Connecticut," and 15 feet less in length, is a vessel with a flush main deck, a high freeboard, and a lofty command for the guns of her main and intermediate batteries. She is protected by a continuous belt of Krupp armor at the waterline, which varies from a maximum thickness of 11 inches amidships to a minimum thickness of 4 inches at the bow and stern. She has also a wall of side armor, which extends from the forward to the after barbette and reaches from the top of the waterline belt to the level of the main deck. This armor is 6 inches in thickness, and at the ends of the armor 6-inch bulkheads are carried athwartship



Waterline Length, 176 feet, 5 inches. **Beam,** 45 feet, 7¾ inches. **Draft,** 16 feet, 5¾ inches. **Displacement,** 1,800 tons.

STEEL TRAINING SHIP "CUMBERLAND," RECENTLY LAUNCHED AT BOSTON NAVY YARD.



Displacement, 14,948 tons. **Speed,** 19 knots. **Bunker Capacity,** 1,704 tons. **Armor:** Belt, 11 inches to 4 inches; turrets, 12 to 8 inches and 6½ to 6 inches; barbettes, 10 inches and 6 inches; deck, flat, 1½ inch, slope, 3 inches. **Armament:** Four 12-inch 40-caliber B. L.; eight 8-inch 45-caliber B. L.; twelve 6-inch 50-caliber R. F.; twelve 3-inch R. F.; twelve 3-pounders; eight 1-pounders; two 3-inch field guns; six automatic guns; two machine guns. **Torpedo Tubes,** 2 submerged. **Complement,** 812.

BATTLESHIP "GEORGIA," RECENTLY LAUNCHED AT BATH, MAINE. ALSO SISTER SHIP "NEBRASKA," LAUNCHED RECENTLY AT SEATTLE.

to the barbettes, to afford protection against end-on fire. The protective deck is 3 inches in thickness on the slopes, and 1½ inches on the flat, and at the sides it is curved down to a junction with the lower edge of the waterline belt. A heavy shell from the enemy, therefore, would have to penetrate the main belt and the sloping 3-inch deck, and pass through the mass of coal in the coal bunkers, before it could reach the engine or boiler rooms or the ammunition supplies.

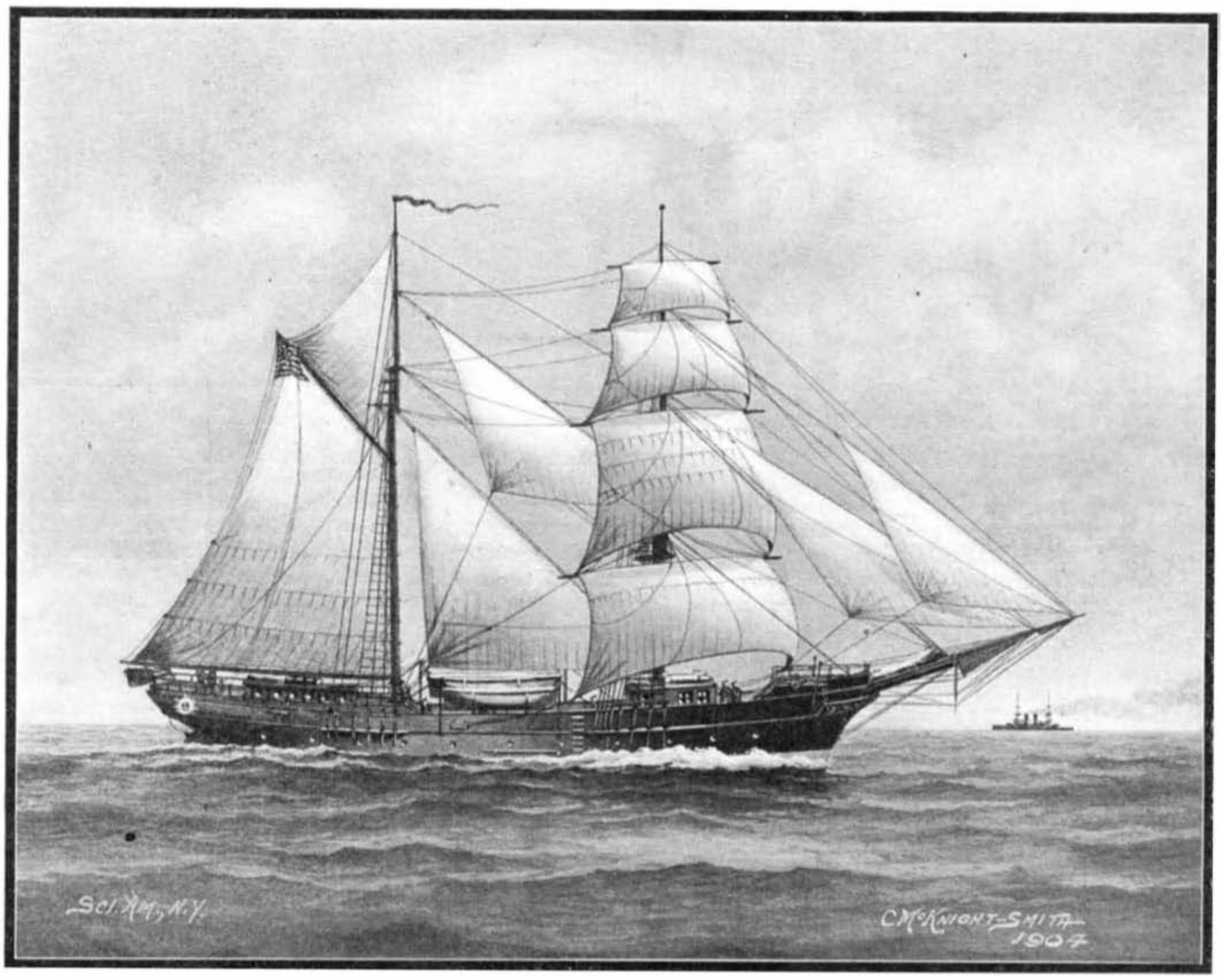
The central broadside battery, formed by the 6-inch walls of armor and their associated bulkheads, contains twelve 6-inch, 50-caliber, rapid-fire guns of the latest pattern, arranged six on each broadside. These fire through recessed casemates, and they are provided with semicircular shields, which are adjusted to close the casemate opening, sufficient space only being left between the semicircular shield and the casemate to give clearance when the gun is being traversed. Upon the same deck, forward in the bows, are four 3-inch, rapid-fire guns, firing through casemates that are protected by 2 inches of armor. Four guns of the same caliber are mounted near the stern on the same deck, and behind similar protection. Forward and aft of the central battery are the two barbettes for the main turrets. These are protected by 10 inches of Krupp armor in front and 7½ inches in that portion that lies within the bulkheads of the central battery. The turrets that are mounted above these barbettes are of the superposed or double-deck type, carrying a pair of 12-inch 40-caliber guns on the lower deck, and a pair of 8-inch 45-caliber guns on the upper deck; the lower portion of the turret being protected by 12 inches of Krupp armor, and the upper portion by 8 inches of armor.

The "Georgia" class are the ships regarding whose armament there was so much discussion in our Naval Board on Construction; the present design was adopted as a compromise, and it is probable that these are the last ships on which the double turret will be mounted. The chief objection to the type is that four guns might be put out of action by a single shot; moreover, the firing of any one gun of the four has a disturbing effect upon the sighting of the other guns in the turret. In addition to the four 8-inch guns carried in the double-deck turrets, there are four others carried in pairs in two barbette turrets, protected by 8 inches of armor and placed on either broadside. These 8-inch guns are sponsoned out sufficiently to give them a line of fire dead ahead and dead astern. Within the superstructure on the main deck are mounted four 3-inch rapid-fire guns, protected, like those on the main deck, by 2 inches of casemate armor. There are 9 inches of Krupp steel on the forward conning tower, and 5 inches on the after conning tower, generally known as the signal tower.

It will be seen from a glance at the ship and from this description that the concentration of fire is very heavy, consisting of two 12-inch, six 8-inch, and four 3-inch ahead and astern, while the broadside consists of four 12-inch, six 8-inch, six 6-inch, and six 3-inch guns. There is no ship afloat that can compare with this in intensity of fire, even the "Connecticut" and "Louisiana" having less by a pair of 8-inch. The arc of fire is also very satisfactory, the 12-inch guns having 270 degrees, the 8-inch superposed guns 270 degrees, the 8-inch guns amidships 180 degrees, and the 6-inch 110 degrees. The ammunition hoists are electrically operated, and they are designed to supply the various guns at a slightly faster rate than the maximum rate of fire. The ammunition supply consists of 240 rounds for the 12-inch; 1,000 rounds, or 125 per gun, for the 8-inch; 2,400 rounds, or 200 per gun, for the 6-inch; and 3,000, or 250 per gun, for the 3-inch pieces. The battery of smaller guns consists of twelve 3-pounders, four 1-pounders, four 1-pounder automatics, two Gatlings, and six Colts. There are two submerged torpedo tubes carried in the forward part of the ship. The motive power consists of two sets of four-cylinder triple-expansion engines of a designed indicated horse-power of 19,000, under which the vessel is designed to make on trial 19 knots an hour. The maximum supply of coal is 1,704 tons, and the complement of officers and men is 812.

Of the two gunboats illustrated, the more important is the steel training ship "Cumberland," which has a length of 176 feet 5 inches, a beam of 45 feet 7¾ inches, and a draft on a displacement of 1,800 tons of 16 feet 5¼ inches. The sister ship "Intrepid" is being built at the navy yard, Mare Island, Cal. The vessel is propelled by sail only and, as will be seen, she is bark-rigged. She carries a battery of six 4-inch, 40-caliber rapid-fire guns, four 6-pounders, two 1-pounders, and two Colts. The 4-inch guns are carried in broadside on the gun deck, the 6-pounders forward and aft on the main deck, and the 1-pounder guns amidship on the same deck. At first sight the "Cumberland" would appear to be a steam auxiliary; but as a matter of fact the smokestack shown is merely to serve the boilers which supply steam to the various auxiliaries, consisting of two 24-kilowatt generators, two 4,070-gallon evaporators, two 3,000-gallon distillers, a steam windlass, an electric winch, and fire and drainage pumps. The vessel has accommodations for a complement consisting of a commanding officer, nine wardroom officers, six warrant officers, and 320 men.

The little wooden brig "Boxer," built also for the training service, is 108 feet in length on the waterline, 29 feet 11 inches in breadth, and on a displacement of 345 tons will draw 9 feet 6 inches. The hull is built of yellow pine planking and white oak timbers, and is copper-sheathed below the waterline. She is built with berth, main, forecastle, and poop decks. She carries a 24-foot cutter, 20-foot whale boat, and an 18-foot dinghy. Accommodations are provided for a commanding officer, two other commissioned officers, and a crew of sixty landsmen and apprentices.



Waterline length, 108 feet. **Beam,** 29 feet 11 inches. **Draft,** 9 feet 6 inches. **Displacement,** 345 tons.

WOODEN TRAINING BRIG "BOXER," LAUNCHED AT NAVY YARD, PORTSMOUTH.

Owing to satisfactory experiments which have been carried out, the officials of the Pennsylvania Railway Company have decided to do away as much as possible with manual work and have the work done by machinery. At points where compressed air or electricity can be employed it has been decided to employ new methods of handling material.

Detection of Radio-active Substances.

BY E. BALLMAN.

The methods generally used for testing the radioactivity of substances are those employing the electroscope and the dry plate. Both of these methods require a great deal of time, and relatively a large amount of material to be tested. These disadvantages can be avoided by using a method which depends on the principle of the spinthariscope, that is, this test for radio-activity consists of observing the scintillations produced by a mixture of phosphorescent zinc sulphide and the radio-active substance under investigation.

The apparatus needed is very simple, merely a quantity of phosphorescent zinc sulphide and a magnifying lens of about one-half inch focus. The phosphorescent zinc sulphide can be bought or made as follows: Add NH_4OH in excess to a clear solution of $ZnCl_2$ until the precipitate first formed is completely redissolved. Then pass H_2S into above solution until all ZnS is precipitated. Filter, but do not wash. Scrape precipitate into an evaporating dish and, stirring, heat until dry. Powder the mass, and heat in partly-covered porcelain crucible with blast-lamp until all fumes are driven off, then close and raise heat to highest point for ten or fifteen minutes. Let cool with cover on. The phosphorescent sulphide feels gritty under a stirring rod, and after exposure to sunlight, shines with greenish-yellow light, which can be seen in a darkened room. The microscope used to observe the scintillations is composed of two simple one-inch focus lenses placed close together and mounted on a stand so that it can be focused on any object placed underneath. The aperture of the lens combination should be about one-half inch.

With this simple apparatus in a dark room, it is possible to test the radio-activity of a substance even lower than that of uranium oxide. The testing can be done best at night, because the eyes are much more sensitive to light. Before entirely darkening the room, mix as much phosphorescent zinc sulphide as will go on the point of a knife with an equal volume of the powdered substance, as Welsbach gas mantle, which is to be tested. Place this in a small flattened heap in the focus of the microscope and then darken the room. After five or ten minutes bring the eye close to the glass, and small flashes of light can be distinctly seen. The zinc sulphide should be kept in the dark, until it loses its phosphorescence, before mixing with the substance to be tested.

In this manner one can judge roughly the relative radio-activity of such ores as carnotite, pitch-blende, monazite sand, etc. It is also useful in testing residues and precipitates, which are obtained in extracting radium from the ores containing it.

Aluminium-tin alloys have been experimented with by E. S. Shepherd. (Journ. Phys. Chem.) Between 10 and 50 per cent aluminium, the author found that an increase of aluminium was always accompanied by a rise of freezing-point. By pipetting samples off from top and bottom of the molten alloy containing 18 per cent aluminium, in some cases with a small percentage of lead added, it is shown that there is no tendency to separation into two liquid layers. From analyses of alloys of aluminium and tin with silver the author believes that a solid solution does exist. From the curve of specific volumes, from the microstructure, and from the thermal measurements, the author concludes that 20 per cent tin is the limiting concentration of tin in aluminium.

A PECULIAR LILY.

BY HERBERT I. PRIESTLEY.

Two American teachers in the Philippines, while walking some time since in the fields in the vicinity of Nueva Cáceres, in Southern Luzon, came across a peculiar specimen of the lily family of plants which has not yet apparently been noticed by scientists.

It was while passing through a dense cluster of underbrush that the gentlemen noticed a remarkably strong odor of decaying flesh which seemed to emanate from the ground close by. Suspecting the presence of some gruesome thing concealed in the bushes, they commenced to search. They were assisted in this by the presence of numerous "blue-bottle" flies, which seemed to be buzzing about some object half concealed under the dense vegetation. This object proved to be the plant shown in the accompanying illustration. The strong smell of rottenness given off by the plant attracted all manner of insects, which was not surprising, as the odor was so strong as almost to repel all investigation.

The plant is called by the native Bicols "borac sa Mayo," that is, May flower. It blooms only during the month of May. It is no doubt a member of the order *Lilaceii*, better commonly known as the lily or tulip family. It has the large bulb, the inconspicuous calyx, the pronounced stigma, and the characteristic structure of lilies in general. The remarkable features of this particular variety of lilies are that it has such a pungent odor and that it has absolutely no leaves at the time of blossoming. These appear later, when the flower has died. The blossom rests immediately on the ground, and is not more than eight or nine inches high. The calyx often measures a foot in diameter.

After the blossom has disappeared the leaves begin to sprout from the bulb. These often grow to the height of three or four feet. Their general shape is similar to that of the leaves of the calla lily, but they are divided into an irregular number of lobes or fronds.

The corolla and the remarkably exaggerated stigma exude a clear viscous fluid which seems to be the cause of the offensive odor. This fluid attracts the flies, thus insuring the transmission of the pollen from plant to plant.

The large bulb, in fact all parts of the plant, have the peculiar acrid juice which is so poisonous, a trait common to the lilaceous order. The acrid taste and the poisonous effect of the juice are lost upon cooking for several hours. During the period of frondescence there is no odor present. This plant is not used for food by the natives where it is found, though there are several other species of the same order which are highly esteemed by them as food.

BLACK LILY.

AN ANIMAL NEW TO SCIENCE AT THE NEW YORK ZOOLOGICAL PARK.

Among a collection of some twenty living animals received some time since by the New York Zoological Society from Capt. Thomas Golding, of the ship "Alfrida," was a small, white creature that proved to be a puzzle to all natural history experts who saw it. It is 21 inches long—a little more than 27, counting in the tail—and stands rather more than 10 inches high at the shoulders.

It rather resembles a small Spitz dog, but it is not a dog any more than it is a raccoon, although the shape of the head and the face marking that seem to belong so peculiarly to the family of *Procyonidæ*, are marvelously imitated in this little beast. Perhaps it resembles a white Arctic fox more than it does any other creature. It had been called a white fox in the country, northern Japan, from which Capt. Golding obtained it, but it is evidently no more a fox than it is a dog or a raccoon.

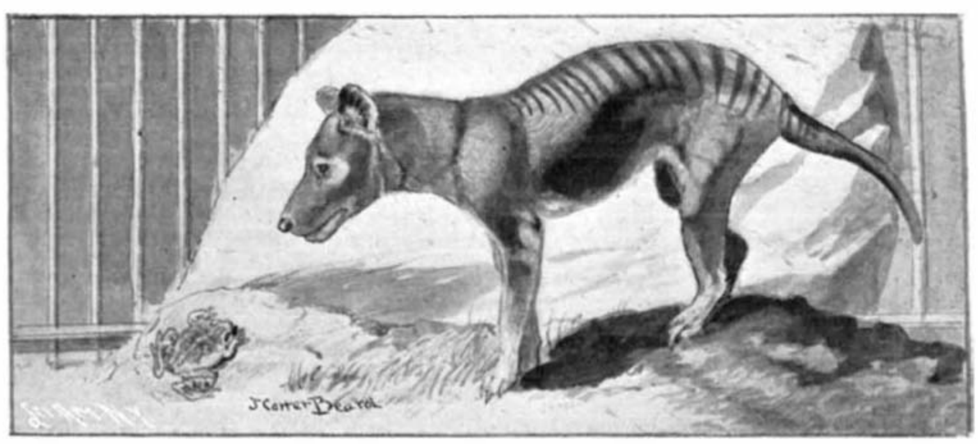
"An examination of its external characters," says the director of the New York Zoological Park, Mr. W. T. Hornaday, "reveals an unmistakable resemblance to *Nyctereutes procyonoides*, the so-called raccoon dog of Japan and of north China. Insomuch as the animal seemed to be immature, and it appeared possible that its pelage might undergo seasonal changes of some importance, it was decided to defer bringing it into notice, and keep it under observation for at least a year.

"During the fifteen months which this strange animal has passed at the Zoological Park it has not undergone any noteworthy change in pelage, nor has it perceptibly increased in size. It therefore seems fairly conclusive that the creature is adult and that its colors are constant throughout the year. As it is certainly not an albino individual of the well-known raccoon dog, referred to above, with living specimens of which it has lived in constant comparison, there appears to be no escape from the conclusion that we have here the living representative of a species of animals hitherto unknown."

It has now been admitted to the great assembly of classified animals under the name of *Nyctereutes albus* or the white raccoon dog.

It is a pretty little creature, gentle in disposition, and is well worth a visit to the park to see. It is not often one gets an opportunity of gazing upon a brand-new animal never before known to scientific zoologists. The allied species *Nyctereutes procyon* or *Canis procyonoides*, according to Mivart, who makes only one genus of dogs, wolves, foxes, and raccoon dogs, is said to hibernate in the winter. If this is true it forms a most remarkable exception to any other known animal of the dog kind. We are told that those of the tribe that do this (for according to all accounts some of the raccoon dogs hibernate while others do not) look up old, deserted fox burrows or those of some other animal if they can, for their bedrooms, but are quite capable, should they not be able to save themselves work in this way, of digging their own burrows. As for the little animal at the park, she certainly evinced no disposition, severe as was the weather at times last winter, of remaining asleep in the comfortable sleeping quarters assigned her, when feeding time came around. Nor are the feet of the creature—short, small, and weak, with claws of little strength—well calculated for digging burrows. As Mr. Hornaday says: "As a whole the animal is not physically robust, nor is it at all vicious in temper. On the contrary it has taken kindly to its keepers and to captivity. Its teeth are small and weak, and taken altogether it is poorly equipped for self-preservation. It requires a home not overrun by bears, wolves, foxes, or the larger members of the family Mustelidæ. It very probably inhabits moist lowlands rather than dry and rugged highlands."

Another very rare animal—so far as the writer knows, the first animal of its kind ever seen on this side of the Atlantic—the so-called Tasmanian wolf, zebra wolf, or pouched dog, *Thylacinus cynocephalus* is to be seen at the New York Zoological Park. Although not new to science it is in some respects a more interesting animal than the white raccoon dog. The "Tasmanian wolf," so far from being a wolf, does not belong to the dog family. It is, in fact, a marsupial, and is more nearly akin to certain of the kangaroos than it is to the Canidæ. The female, indeed, has a well developed pouch, though the marsupial bones are wanting, being replaced by cartilages. The animal walks upon its toes and partly upon half its soles or palms, as may be seen more evidently in the hind feet; this causes the body to be brought much nearer the ground in running than is the case with a wolf or dog, and constitutes the Tasmanian wolf a semi-plantigrade. The lower canine teeth in dogs pass on the outer sides of the upper ones when the mouth is closed, while the larger recurved canines of the Tasmanian wolf in the upper jaw are separated from the incisors by a space into which the points of the lower canines fit when the jaw is shut. The animal has the peculiar lower jaw of the marsupials—the angle is inflected; it is, in fact, a marsupial with structural parts foreshadowing those of the more highly developed dog. Such an animal as this transports us back to those primeval times when animals far more generalized than those that now exist united in themselves diverse characteristics and specific features never, in our day (save in a few such instances as the Tasmanian wolf), found in any one individual or any one species.—J. C. Beard.



DOG-LIKE DASURE, AN ANIMAL WITH A POUCH, RELATED TO THE KANGAROO.

THE WHITE RACCOON DOG—AN ANIMAL NEW TO SCIENCE.

The Supply of Ivory.

During a recent visit to the London Docks, says Knowledge and Scientific News, Her Majesty the Queen was informed that the stock of ivory then shown represented, on an average, the annual slaughter of some 20,000 African elephants. This statement has been contradicted in two letters in the daily papers. In one of these Messrs. Hale, of 10 Fenchurch Avenue, state that at least 85 per cent of the supply is "dead ivory," mainly obtained from hoarded stores of African chiefs, who are shrewd enough to put their commodities on the market only in driblets. The most interesting part of the letter is, however, the statement that the great bulk of this hoarded ivory is obtained from "elephant cemeteries"—spots met with here and there in the jungle, where elephants have resorted for centuries to die. Much of the ivory that comes to the market may, therefore, according to this letter, be several hundred years old. The marvel is why it is not devoured in the jungles by porcupines, as certainly happens with tusks of the Indian elephant which are left in the jungle.

RECENTLY PATENTED INVENTIONS.

Apparatus for Special Purposes.

AMMONIA-WATER APPARATUS.—H. A. Abendroth, Berlin, Germany. This invention relates to evaporation and condensation; and its object is to provide certain improvements in ammonia-water whereby the overflow-pipes for the water can be readily removed from the cells for cleaning and other purposes and without requiring interruption of the process or unduly reducing the strength of the walls of the cells.

Of Interest to Farmers.

FERTILIZER-DISTRIBUTER.—J. C. Sparks, Mechanicsville, S. C. In this patent the invention is an improvement in fertilizer-distributers, having for an object to provide a novel construction which can be applied to an ordinary plow-beam, can be set in any desired adjustment on said beam, and will efficiently serve the purpose for which it is designed.

Of General Interest.

SUSPENDER ATTACHMENT.—L. Selikowitz, New York, N. Y. The attachment comprises a friction plate with means for attachment to one end of the suspender, said plate being provided with a hinged bar. The plate and bar are constructed with co-operating clamping members for securely holding in place a pull device constituting the medium by which the sliding movements of the adjusting device are effected for the purpose of altering the length of the suspender member.

Hardware.

REGISTERING-LOCK.—J. G. Ramey, Rome, Ga. A lock constructed according to this invention has merit over all similar locks in the construction involved, as well as the simplicity of its working parts, which are not so liable to get out of order. It has utility or usefulness in recording its unlocking and the registering of the number of times it has been worked or unlocked.

WIRE-STRETCHER.—O. C. A. Schwien, Davenport, Iowa. This improvement is in that class of stretchers whose main feature is a lever having a curved portion adapted to engage or partly embrace a fixed post and provided with a wire-grip, which is located at a point between the post and the handle end of the lever. A flexible tension device, preferably a chain, is employed, it being connected with the portion of the lever applied to the post and adapted for ready attachment and detachment, so that the apparatus as a whole may be quickly applied to and removed from the post.

Heating and Lighting.

FURNACE.—G. S. Kent, Lyndon, Vt. The aim of the improvement is to provide a furnace of economic construction capable of utilizing all the products of combustion to a maximum extent, in which furnace a continuous combustion-chamber is provided and two fuel-chambers in communication with the combustion-chamber, together with means for admitting air and the steam to the combustion-chamber and for the admission of stoking-tools to the fuel-chambers.

Machines and Mechanical Devices.

HOIST.—S. T. Wallace, Los Angeles, Cal. This hoist is intended especially for use in the construction of buildings to hoist building materials from one floor to another. The hoist lies outside of the building, being erected on the sidewalk immediately in front of the structure where it will occupy very little space. The arrangement of the hoist is such that it will elevate beams of a length too great for elevation through the interior of the building.

MACHINE FOR FORMING CURRY-KNIFE EDGES ON ROTARY CUTTERS.—E. Schroeder, New York, N. Y. The object of the improvement is to provide a machine more especially designed for accurately forming an annular curry-knife edge on a circular cutter—such, for instance, as is used in a fleshing and shaving machine for raw and dressed furs or skins, for which former Letters Patent were granted this inventor. The present invention is a division of the application for Letters Patent of the United States for a machine for grinding and forming cutter edges, formerly filed by Mr. Schroeder.

Designs.

HAMMOCK CLOTH.—D. W. Shoyer, New York, N. Y. The design consists of a central initial letter surrounded by scrolls and flower ornaments which are artistically arranged.

DESIGN FOR A CHAPLET OR SHRINE OF THE HOLY ROSARY.—C. Gay, New Haven, Conn. This is a design in which the figure is a perspective view of the chaplet or shrine of the Holy Rosary. Around a prominent crucifix and two small crosses, are inscribed St. Dominic's Chaplet of the Holy Rosary. The face of the ornamental design is oblong, square at the bottom and round at the top. A square in the center is surrounded by a chain looped at the lower part.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of **the invention, and date of this paper.**

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 6081. For the manufacturer of a clip or band used in construction of brick walls, called the "Don't Clip Brick Band," patented July 7, 1903.

Autos.—Duryea Power Co., Reading, Pa.

Inquiry No. 6082.—For makers of apparatus, etc., for fitting up corn mills.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 6083.—For a small, triple-expansion marine engine, developing about 25 h. p. on 200 pounds of steam at about 700 r. p. m.

Perforated Metals, Harrington & King Perforating Co., Chicago.

Inquiry No. 6084.—For the manufacturers of the "Kleen U Rite."

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 6085.—For dealers in peat for use as fuel.

If it is a paper tube we can supply it. Textile Tube Company, Fall River, Mass.

Inquiry No. 6086.—Wanted, a gasoline motor of 4 to 6 h. p., for plowing purposes.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 6087.—For the latest and best appliances for a crematory.

D. A. Beaton, Practical Lead Burner, P. O. Box 334 Woburn, Mass. Fifteen years' experience.

Inquiry No. 6088.—For makers of blank name checks on which to stamp names, addresses and emblems, also of stamps with which to stamp them.

Microscope.—$15; cost, $35. Also valuable accessories separate. List. J. Phin, Paterson, N. J.

Inquiry No. 6089.—For makers of round glass covers 6 inches diameter by 8 inches high.

American inventions negotiated in Europe. Wenzel & Hamburger, Equitable Building, Berlin, Germany.

Inquiry No. 6090.—For dealers in second-hand electric instruments and machinery.

Agents wanted to sell the Ryede puzzle. Sample by mail for 10c. Ryede Specialty Works, Rochester, N. Y.

Inquiry No. 6091.—For a machine for printing on toothbrush handles.

In buying or selling patents money may be saved and time gained by writing Chas. A. Scott, 719 Mutual Life Building, Buffalo, New York.

Inquiry No. 6092.—For machinery for peeling, cracking, cleaning and bleaching walnuts.

We manufacture anything in metal. Patented articles, metal stamping, dies, screw mach. work, etc. Metal Novelty Works, 43 Canal Street, Chicago.

Inquiry No. 6093.—For outfits and supplies for confectioners, bakers, etc.

Patented inventions of brass, bronze, composition or aluminum construction placed on market. Write to American Brass Foundry Co., Hyde Park, Mass.

Inquiry No. 6094.—For manufacturers of broom-making machinery.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company Foot of East 138th Street, New York.

Inquiry No. 6095.—For manufacturers of wood and metal lathes, saws, drills, work benches, etc., for manual training school.

Wanted.—Experienced office man who will invest $15,000 in a well-established manufacturing company in Central Indiana. Investment, Box 773, N. Y.

Inquiry No. 6096.—For builders of steam engines for automobiles, or makers of steam automobiles.

Want manufacturer to buy pat. No. 760,280 elect. water heater. Boils pint of water in 1 minute. Sample with attachment plug, $1.25. Richard Toennes, Box 344, Boonville, Mo.

Inquiry No. 6097.—For manufacturers of machinery for excelsior plants.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 6098.—For makers of compressed paper, to be used as a substitute for leather.

Patents for Sale.—Cantwell & Co., patent agents, Calcutta, India, has now for sale several valuable patents, principally for railway improvements. Full particulars on application.

Inquiry No. 6099.—For dealers in new and second-hand gasoline launches, 30 to 35 feet long.

Inventor wants prominent business man as partner to finance some series of first-class inventions: Auto, railroad, iron, building and other branches. A. von Duczynski, P. O. Box 54, Bellevue, Pa.

Inquiry No. 6100.—For the makers of an apparatus called "Long Tom" which is fixed on the wall, and a coin is fired by a small cannon.

For Sale.—Canadian patent No. 83,867, dated Nov. 10, 1903. Covering vital points in telephone development. Important subsequent improvements free to purchaser. Address Dennis O'Brien, Limestone, New York.

Inquiry No. 6101.—For manufacturers of keys, without heads, to be used in the manufacture of farm machinery.

Winona, Minnesota.—Population, 24,000—Wants Manufacturing Plants. For particulars address Geo. W. Gregory, Secretary of Board of Trade

Inquiry No. 6102.—For manufacturers of soldering iron for aluminium.

Wanted—Revolutionary Documents, Autograph Letters, Journals, Prints, Washington Portraits, Early American Illustrated Magazines, Early Patents signed by Presidents of the United States. Valentine's Manuals of the early 40's. Correspondence solicited. Address C.A. M., Box 773, New York.

Inquiry No. 6103.—For a freezing apparatus for making ice in small and large quantities.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Inquiry No. 6104.—For manufacturers of screw machines, monitor lathes and drill presses.

Situation wanted by young German with commercial experience, having studied engineering in Berlin, wanting a start. G. K., Box 773, N. Y.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(9469) C. R. W. asks: Can you give me any information on the computation of time as we now have it—months, weeks, days, hours, minutes, and seconds? When did this computation begin or come into use, and what preceded that computation, and so on as far back as we have any history on this subject? A. There is not so much exact data as one might expect regarding the time of the introduction of the different units of time we now employ. Probably many of them came into use gradually and without any official determination, just because they were convenient and serviceable. The year was naturally connected with the seasons, and has been kept with the seasons by most nations. It is more essential that it should begin at about the same time with reference to seed time and harvest than that it should be invariable in length. Thus our years are not of the same length. The month was also a natural epoch, in the earliest times, dating from the phases of the moon. While the day has always been a natural unit of time, the time of its beginning and its division into parts have varied greatly. This is discussed in answer to Query 8744, Vol. 87, No. 19. Our calendar, the Julian, dates from 45 A.D., and its reformation by Pope Gregory in 1582 A.D., while its adoption by England was in 1752 A.D. All that is known on these points may be had from encyclopedias.

(9470) W. L. asks: Will you kindly advise me whether the current in Western Union telegraph wires would interfere with the working of a ground circuit telephone line on the same poles, and if so, what could be done to equalize the current, or as a remedy? A. A telephone line is liable to disturbance from any unsteady electric current in its neighborhood, if a ground return is employed. The remedy is to use a metallic circuit, with the wires twisted, as is done in cities. The effect of induction is thus done away with.

(9471) C. H. W. asks: What would be the result of an electro-magnet which is capable of lifting ten times more than its own weight, and a piece of metal that weighs say eight or ten times as much as the magnet, say iron, be both placed on a level surface about one-half foot or a foot apart, with nothing to hold either stationary, and then turn on the current? What would be the result? Would the magnet go to the metal, or would the metal go to the magnet? A. If a magnet and a piece of iron such as you describe were placed as you state, the magnet would move to the iron ten times as fast as the iron moved toward the magnet, since both would be pulled with the same force, and the motion of the two would be in the inverse ratio to the weights. It is not probable that either would move at a distance of a foot from the other. The magnetic force would not be able to exert pull enough at so great a distance.

NEW BOOKS, ETC.

The Chemistry of Gas Manufacture. By W. J. Atkinson Butterfield, M.A., F.I.C. London: Charles Griffin & Co., Ltd. Philadelphia: J. B. Lippincott Company, 1904. 8vo.; pp. 257. Price, $2.50.

The present is the first volume of this work which has been greatly enlarged in this, the third edition. Volume I. treats of the materials and processes of gas manufacture. All the materials and methods of producing coal, water, oil, and air gas, and of enriching gas of low illuminating power, as well as the methods of producing simple gaseous hydrocarbons, are thoroughly described. The production of acetylene was treated in a separate book written in collaboration with Mr. F. H. Lee, and which has been recently published. The second volume of the work, which is now in course of preparation, will cover the testing and use of gas.

Earthquakes in the Light of the New Seismology. By Major Clarence Edward Dutton. London: John Murray. New York; G. P. Putnam's Sons, 1904. 12mo.; pp. 314.

So rapidly has the method of studying earthquakes developed during the last thirty years, that the science, as it now stands, has been aptly termed the "new seismology." This modernized science investigates its phenomena by means of instruments that measure force and motions, speeds and accelerations. For that reason it may well be considered a branch of physics, a branch moreover that treats of elasticity and wave motion in a solid medium, the earth. Chapter I. of this book sets forth the nature of the earthquake according to modern concepts. Chapter II. is devoted to a general discussion of the causes of earthquakes. The two groups of quakes, the volcanic and the tectonic, have many distinctive characteristics which are described in Chapters III. and IV. The next two chapters, V. and VI., are devoted to detailed explanations of the instruments used in seismometry. Chapter VII. deals with seismic vibratory motion. Passing then to the kinetic aspects of seismic vibration, the subject of intensity is discussed in two chapters. The chapter on Variations in Intensity points out the method of computing the depth and origin of an earthquake. The final chapter is devoted to the discussion of seaquakes, a subject which has been investigated with great diligence by Dr. Emil Rudolph, of Strasburg.

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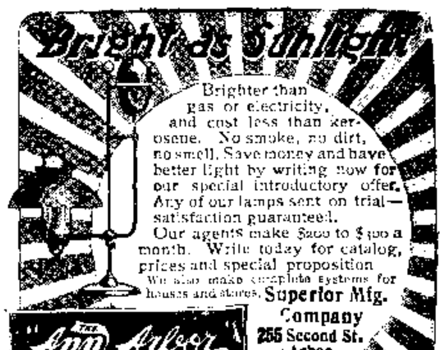

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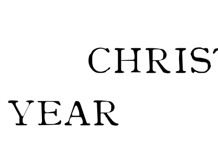

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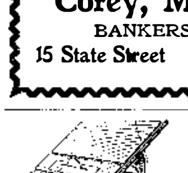

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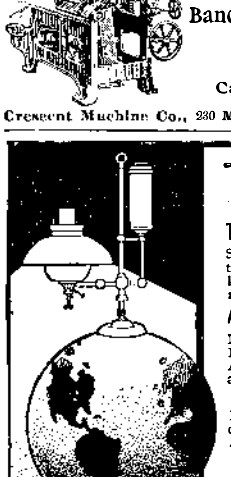

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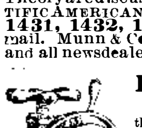

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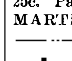

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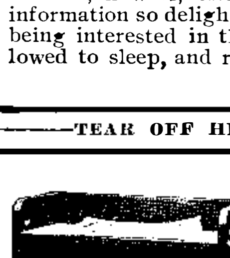

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